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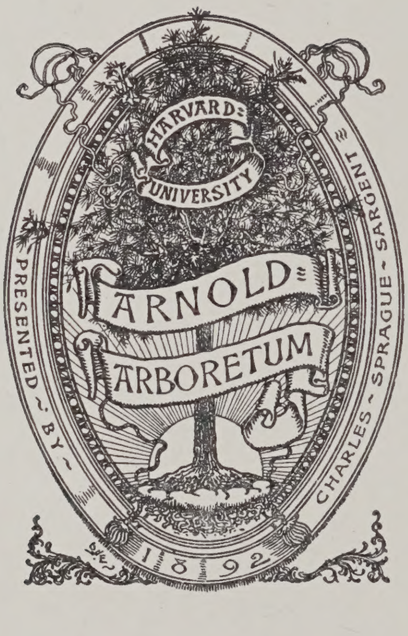
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STUDENTS OF LING NAN AGRICULTURAL COLLEGE, 1923-24

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1924

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LINGNAAM AGRICULTURAL REVIEW.

The agricultural work of Canton Christian College was inaugurated in 1907 when the first agriculturist was appointed to the college staff. The work grew steadily from small beginnings unitl 1921 when it was greatly enlarged in scope by a liberal appopriation from the Kwangtung Government. In the fall of 1921 the Ling Nan Agricultural College was effected. The work is now organized in four divisions: Education, Extension, Industries, Research and Experiments; and five departments: Agricultural Manufacturing, Agronomy, Animal Husbandry, Horticulture and Sericulture.

Before the publication of the first issue of the *Review*, the research work in agriculture carried on at Canton Christian College was published in bulletin or book form, or in such publications as the *Philippine Journal of Science*, *Journal of Dairy Science*, *Journal of Heredity* and the *Lingnaam Magazine* (Chinese).

It is urged that others in the Orient doing research related to agriculture will contribute material for publication in the *Review*.

THE COST OF PRODUCING WATER BUFFALO MILK

C. O. LEVINE AND S. T. TO *

Canton Christian College

The last few decades have witnessed a gradual awakening of interest in the Chinese water buffalo as a milk producing animal. Due to the fact that the milk of the buffalo cow is unusually palatable, and particularly rich in fat and total solids, the demand for this milk is increasing, especially in the Canton region.

No work on the problem of the cost of milk production with buffalo cows has come to the attention of the writers. Experiments and investigations have been conducted on the cost of milk production for European cows by Agricultural Stations in Canada, America, and other countries, but their results would naturally differ from that for buffalo cows. The purpose of this investigation is to study the cost of production of water buffalo milk in the Canton region.

PROCEDURE

The data here recorded are from the Canton Christian College dairy. As the prices of feeds and the cost of labor vary considerably from season to season and are different in different communities, the results hold mainly for the period from July 1, 1921 to May 1, 1922, during which time the study was made for the Canton region.

For this experiment fourteen of the buffalo cows in the college dairy were used. Their ages, length of lactation periods, dates when fresh, body weights and the dates of breeding are given in Table 1. All cows were in good health throughout the experiment. With all except Nos. 69, 85, 95, and 102 the records began on the day of freshening or shortly after and continued for 365 days. For Nos. 85, 95, and 102, the the records began on the day the cows went dry and continued for 365 days. No. 69 freshened January 7th, 1921, went dry November 3, 1921, and freshened again February 28, 1923. The records for her began August 4, 1921, and closed August 3, 1923. The shortest lactation period was 310 days for No. 56; the longest was 359 days for No. 76, and the average for all 14 cows is 337 days.

There are no native breeds of dairy buffaloes in China. The buffaloes are of the kind commonly used by farmers in southern China and the Philippine Islands for draft and beef purposes. While these cows have not had their milking capacity increased by breeding and selection, they are cows that were selected by the college from the ordinary village herds because of the fact that they showed possibilities of giving more milk than the average buffalo in the Canton region.

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*The work of assembling the data for this paper was done largely by the junior author as part of the requirements for the degree of Bachelor of Science in Agriculture.

TABLE 1. DATA REGARDING COWS IN THE Experiment.

Cow No.	Body weight in lbs.	Age of cows	Date freshened	Date exp. started	Length of lactation in days	Date of breeding
52	1200	mature	Aug. 9,'21	Aug. 9,'21	335	Mar. 31,'21
56	995	,,	Oct. 25,'21	Oct. 25,'21	331	Dec. 10,'21
69	902	,,	Jan. 7,'21	Aug. 4,'21	310	Mar. 30,'21
71	1136	,,	Dec. 10,'21	Dec. 10,'21	348	June 21,'21
76	1116	,,	Mar. 20,'22	Mar. 22,'22	359	Aug. 26,'22
77	1309	,,	Apr. 13,'22	Apr. 13,'22	356	July 29,'22
79	1138	,,	Mar. 24,'22	Mar. 24,'22	342	June 30,'22
85	1042	,,	May 30,'21	Aug. 4,'21	334	Oct. 8,'21
87	942	,,	Aug. 17,'21	Aug. 17,'21	348	Oct. 8,'21
95	1035	,,	Dec. 16,'21	Oct. 1,'21	341	Jan. 27,'22
101	1194	,,	Apr. 7,'22	Apr. 7,'22	331	Sept. 7,'22
102	1035	,,	June 15,'22	May 1,'22	329	Sept. 28,'22
106	1048	,,	Sept. 2,'21	Sept. 2,'21	329	Dec. 13,'21
107	1048	,,	Nov. 5,'21	Nov. 10,'21	335	Jan. 13,'21

The following items have been considered in determining the actual cost of buffalo milk production, all being reduced to the unit basis of a single cow.

1. Feeds.
2. Labor.
3. Annual interest and depreciation on cows.
4. Annual interest, repairs and depreciation on buildings and equipment.
5. Fuel.
6. Milk bottles.
7. Miscellaneous items.

CONCENTRATES

The cost of feed is one of the principle factors that enters into the cost of production. The concentrates fed in this experiment consisted of rice bran, wheat bran, broken rice, peanut cake and soy beans. Two different grain mixtures, designated as Nos. 1 and 2, were used during the time covered in the experiment. Only five out of the 14 cows, namely, Nos. 76, 77, 79 and 102 were carried through on the two grain mixtures. The other cows were on mixture No. 1 for the entire period. Grain mixture 1, which consisted of seven parts of rice bran, three parts of wheat bran, two parts of broken rice and one part of ground peanut cake by weight was fed from June 1921 to December 24, 1922. Grain mixture 2, consisting of seven parts of rice bran and four parts of wheat bran by weight, was fed beginning December 24, 1922, to April 10, 1923. During part of this period some broken rice and ground soy beans were also given to cows. This was done principally during the time when grain mixture No. 2 was fed. The amount of grain fed to each cow was based on the amount of milk produced and the condition of the cow. An average of about three pounds of the grain mixture for each four pounds of milk produced was given to each cow daily. The cows were fed twice a day, at five o'clock in the morning and at five o'clock in the evening. Once a day, a day's ration was weighed into the drawers of a feeding cabinet which had a drawer for each cow. The daily amount of grain for each cow was indicated on cards tacked to the drawers of the cabinet. This amount was changed from time to time to conform with the production and condition of the cows. About 15 ounces of salt mixed with the concentrates was fed daily to the cows. The concentrates at each feeding were mixed with enough water to make a thick mash. Table 2 shows the total amount of concentrate feed calculated from the grain mixtures 1 and 2 and the additional grains fed.

TABLE 2. TOTAL CONCENTRATES CONSUMED.

Cow No.	Rice bran lbs.	Broken rice lbs.	Wheat bran lbs.	Peanut cake lbs.	Soy bean lbs.	Total lbs.
52	1020	303	437	146	30	1936
56	1001	298	429	143	60	1931
69	688	292	286	96	60	1402
71	984	281	422	141	60	1888
76	597	133	278	67	60	1135
77	536	115	254	58	60	1023
79	952	222	438	107	60	1779
85	878	143	376	126	00	1523
87	760	228	326	109	30	1453
95	852	244	356	122	60	1643
101	419	110	187	55	60	828
102	486	109	224	55	30	904
106	967	279	414	138	30	1828
107	969	284	415	139	40	1836
Totals	11,109	3,041	4,842	1,502	640	21,109

Prices for feeds have risen rapidly during the past two years on account of the civil war and labor strikes. Table 3 indicates the prevailing prices for this period.

TABLE 3. PRICES OF FEEDS*

Feeds	100 lbs.
Broken rice	$4.31
Wheat bran	4.31
Rice bran	2.87
Peanut cake	6.00
Soy beans	6.37
Green grass	0.20
Rice straw	1.00

ROUGHAGE

Green native grasses, cut mainly from uncultivated lots and roadsides on the college campus, were given from April 1 to December 1 of each year. During the remainder of the year rice straw was the roughage fed. The amount of green grass and rice straw required was found in another study made by the writers. In this study green grass was fed four times a day. In one trial 25 pounds were given and 19 pounds was the average amount consumed while in a second trial, 18.5 pounds were consumed when 20 pounds of green grass were given. Consequently 20 pounds was taken as the average amount for a cow at each of the four daily feedings, and 80 pounds of green grass was charged to each cow as one day's allowance.

During the period when rice straw was fed an average of five pounds was given at each feeding and 20 pounds were required by the average cow per day.

While it is true that all cows would not eat exactly the same amount of roughage every day, it was found in the roughage consumption test that over a period of several days each cow consumed practically the same amount. For this reason, and because of the difficulty in keeping accurate daily records for any length of time on roughage consumption, such daily records were not made except from time to time as a check.

---

* Throughout this paper the prices quoted are in Canton currency, one dollar of which is usually equal to about fifty cents United States currency.

TABLE 4. TOTAL FEED CONSUMPTION AND COST.

Cow No.	Total Amt. of concentrates in lbs.	ROUGHAGE		COST			
		Rice straw in lbs.	Green Grass in lbs.	Concentrates	Rice straw	Green grass	Total Cost
52	1936	2420	19,520	$71.65	$24.20	$39.04	$134.89
56	1931	,,	,,	27.29	,,	,,	135.53
69	1402	,,	,,	53.56	,,	,,	116.80
71	1888	,,	,,	70.63	,,	,,	133.87
76	1252	,,	,,	47.40	,,	,,	110.64
77	1025	,,	,,	38.63	,,	,,	101.87
79	1779	,,	,,	65.83	,,	,,	129.07
85	1523	,,	,,	54.95	,,	,,	118.19
87	1453	,,	,,	54.01	,,	,,	117.25
95	1643	,,	,,	61.69	,,	,,	123.93
101	828	,,	,,	24.82	,,	,,	88.06
102	904	,,	,,	33.43	,,	,,	96.67
106	1828	,,	,,	67.64	,,	,,	130.88
107	1836	,,	,,	68.61	,,	,,	131.85
Totals	21,228	33,880	273,280	$745.14	$338.80	$546.56	$1,669.47

Average cost per cow $119.32

COST OF LABOR

Next to feed, man labor is one of the most expensive factors entering into the production of milk. It includes the time spent in milking, feeding, cleaning out the barn, hauling and carrying feed, distributing milk, etc. To perform all these operations it requires one man for every three cows in the herd. The men receive an average of $16.00 per month and board themselves. On this basis the cost of labor for one cow per year is $64.00.

INTEREST AND DEPRECIATION ON COWS

In calculating interest on investment a rate of 8 per cent on the value of the cows was used. The average cost of a good buffalo cow for milk production in Canton is about $200.00 Canton currency. The interest at eight per cent. is $16.00 per year. This depreciation on the cows may seem high, but in our experience it is none too high. According to other dairies in this locality, the annual death rate of European cows is about 27 per cent.

INTEREST, REPAIRS AND DEPRECIATION ON BUILDING AND EQUIPMENT

The cost of building and equipment for 14 cows is estimated at $1,200. Interest at 8 per cent. is $6.85 for each cow for one year. Depreciation and repairs are figured at 6 per cent. or $5.14 per cow, making a total of $12.09 for interest, depreciation and repairs of buildings and equipment for each cow per year.

FUEL

Fuel for boiling water which is used to wash the utensils and the udder of the cow before milking and also to supply the men for kitchen purposes and lighting is figured at $1.50 a month per cow. The cost of wood was very high, being from $1.00 to $1.20 per 100 pounds.

MILK BOTTLES

Bottles imported from America or England cost an average of 14 cents local silver for one-half pint, 18 cents for pint and 26 cents for quart bottles. The figures include freight to Canton. Locally made bottles are very unsatisfactory due to lack of uniformity in size, and the readiness with which they break when scalded, and although their first cost is lower than imported bottles, the loss through breakage is so high that in the long run they are more expensive. The loss in bottles is generally estimated in America at 15 to 20 per cent. That is, for every 100 bottles sent out each day, 15 to 20 are broken, either by customers or in the dairy, or they fail to return. 2000 pounds of milk, which in round numbers is the average yearly production per cow (see table VI), require 2000 pint bottles. If 17 per cent. are lost the loss on bottles per cow per year amounts to $68.00.

MISCELLANEOUS ITEMS

Under the heading of miscellaneous items are included soap, disinfectants, medicines, salt, whitewash and so forth. These items total about $10.00 per cow per year.

MILK PRODUCTION

The cows were milked twice a day and the milk of each cow was weighed immediately after each milking during the test. Buffalo cows give an average of five lbs. of milk a day but the milk contains about three and one-third times as much fat and nearly twice as much total solids as does milk from European cows.

Table 5 brings out the production of milk, butter fat, the average percentage of fat in the milk for each cow during the year and also the cost of feed and other items per pound of milk.

TABLE 5. MILK PRODUCTION AND COST PER POUND OF MILK

Cow. No.	Production of milk in lbs.	Percent of butter fat.	Butter fat lbs.	Cost of feed per lb. of milk.	Cost other than feed per lb of milk.	Total cost per lb. of milk.
52	2648.36	10.93	294.14	$0.051	$0.084	$0.135
56	2913.41	11.15	324.85	0.049	0.079	0.128
69	1500.91	10.32	177.28	0.077	0.154	0.231
71	2316.19	10.92	262.94	0.056	0.100	0.156
76	1491.80	12.12	181.77	0.075	0.155	0.230
77	1474.10	11.96	159.08	0.069	0.154	0.223
79	2349.50	10.50	246.75	0.055	0.095	0.150
85	2074.63	11.31	234.55	0.057	0.112	0.179
87	1835.23	11.23	193.71	0.063	0.121	0.184
95	1724.08	12.72	219.33	0.072	0.132	0.204
101	1337.74	11.61	142.28	0.066	0.173	0.239
102	1399.70	13.81	176.73	0.069	0.168	0.237
106	2445.74	11.99	272.54	0.053	0.094	0.147
107	2281.71	10.41	239.90	0.057	0.101	0.158
Totals	27,793.10		3,125.85	.869	1.722	2.601
Ave.	1,985.22	11.25	223.27	$0.06	$0.117	$0.177

The average milk production for the 14 cows was 1985.22 pounds, testing 11.25 per cent. fat, or an average of 223.27 pounds butter fat per year per cow. The average per cent. (11.25) was found by dividing the total fat for all cows, 223.27 pounds, by the total amount of milk, 27,793.11 pounds.

The average cost of feed per pound, 6 cents, was obtained by dividing the total cost of feed $1,669.50 by the total milk produced, 27,793.11 (see Table VI).

The cost of items other than that for feeds (see Table VI) for each cow was obtained by adding the cost of items other than feed and dividing by the milk production for each cow.

By dividing the cost other than feed for all cows by the milk production, the average costs for all cows of items other than feed, $0.117 cents, was obtained. Table VI summarizes all costs of milk production

TABLE 6. SUMMARY OF COSTS

Items	Average cost per cow.
Feed	119.32
Labor	64.00
Interest and depreciation on cows	54.00
Interest, repairs and depreciation on buildings & equipment	12.09
Fuel	18.00
Milk bottles	68.00
Miscellaneous items	16.00
Total	351.72

Average amount of milk produced by 14 cows in one year - 1,985.22 pounds.
Average cost of one pound of milk - $0.177.

During the months of February and March of 1923 the only roughage available was dry rice straw, and in spite of the fact that the concentrate allowance increased considerably, the cows dropped in milk very markedly during this period which should not have occured if succulent feed had been available.

From Tables 5 and 6 it is noted that the average cost of one pound of milk produced is 17.7 cents, the highest being 23.9 cents for cow 101 and the lowest 12.8 cents for cow 56.

It is shown very clearly in Table 5 that the high producing cows give milk at the lowest cost and the lowest producing cows give milk at the greatest cost.

SUMMARY

1. All records were taken in the college dairy from 14 mature buffalo cows. The records began either at or near the time the cows were fresh, or at the time the cows went dry and continued for 365 days.

2. The average milk production for 365 days for the 14 cows was 1,985.22 pounds containing 223.27 pounds butter fat. According to the prevailing prices this milk was produced at an average cost of six cents per pound for feed consumed, and 17.7 cents is the total cost per pound of milk produced, including, in addition to feed, labor, interest, repairs and depreciation on investment, fuel, bottles and other miscellaneous items.

3. The cost of milk varied considerably with individual cows, being 23.9 cents for cow 101 and 12.8 cents for cow 56. The lowest producing cows invariably give milk at a greater cost than do the high producing cows.

AN ENUMERATION OF THE McCLURE COLLECTION OF HAINAN PLANTS *

G. W. GROFF, EDWARD DING AND ELIZABETH H. GROFF,
Members of the Herbarium Committee,
Canton Christian College

103—Hernandiaceae

103.2831—ILLIGERA RHODANTHA Hance

Tai Tsing (大井), 8228, Oct. 24, 1921; in bushes by roadside; vine: fls., maroon.

105—Cruciferae

105.2949—BRASSICA INTEGRIFOLIA (West) O. E. Schulz.

Five Finger Mt., (五指嶺), 8513, Dec. 22, 1921; wooded ravine; alt., 250 m.; bush; ht., ½ m.; frs., red.

107—Capparidaceae

107.3087—GYNANDROPSIS GYNANDRA (Linn.) Merr.

Kingchow, Hainan (瓊州,海南), 7532, Oct. 14, 1921; thicket; vine; fls., white, unpleasant.

107.3090—POLANISIA ICOSANDRA (Linn.) W. & A.

Hoihow (海口), 7582, Oct. 12, 1921 and *Kam Kong* (金江), 8249, Oct. 26, 1921; sandy, grassy place, dry roadside; herb; fls., yellow.

107.3095—CRATAEVA LOPHOSPERMA Kurz.

Nodoa, Yau Ma Wo (那大,油蔴和), 8113, Nov. 9, 1921; thicket at edge of stream; alt., 250 m.; tree; ht., 12 m.; dia., 15 cm.

107.3095—CRATAEVA RELIGIOSA Forst.

Hoihow (海口), 7578, Oct. 10, 1921; dry field; ht., 10 m.; dia., 30 cm; names reported, *Mung mang mung* (曚蠓曚), *Fu wong* (虎王).

McClure secured an economic specimen of this, C. C. C. Ec. No. 138 (McClure Ec. No. 109). He reported, "The fruits (dried) of *Fu wong* (虎王) are a Chinese drug. The tree would make a good ornamental. It grows to be quite tall, produces a good shade and bears large racemes of fragrant white flowers."

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* This is a continuation of the enumeration of the Hainan collection which appeared in Lingnaam agricultural review, v. 1 (1923), No. 2, pp. 27-86.

The reader is also referred to Mr. F. A. McClure's article, Notes on the island of Hainan, in Lingnaam agricultural review, v. 1 (1922), No. 1, pp. 66-79. pl. 5, map.

107.3101—CAPPARIS HASTIGERA Hance
(CAPPARIS SWINHOII Hance)

Hainan, Hoihow (海南,海口), 8840, Apr. 5, 1922, *Wong Chuk, Tung Ngai* (? ,東崖), 9804, June 2, 1922; city wall; alt., 5 m.; shrub; ht., 2-3 m.; dia., 1½-2 cm.; fls., light yellow with maroon stamens, fragrant; would make a good ornamental; name reported, *Ngau ngan ching* (牛眼睛).

107.3101—CAPPARIS MICRACANTHA DC.

Hainan, Kachek, Wong Chuk (海南,嘉積, ?), 9796, June 1, 1922; among shrubs at roadside; vine; ht., 3-4 m.; fls., white.

107.3101—CAPPARIS SP.

Hainan, Fan Ya (海南,番也), 9520, May 9, 1922, *Five Finger Mt.*, (五指嶺), 8713, Dec. 20, 1921 and *Shui Mun* (水門), 9592, May 14, 1922; on tree in mt. side forest, on bank of stream; alt., 800 m.; vine; ht., 3-10 m.; dia., 5 cm.; fls., white, fragrant; frs., purple when ripe.

112—Droseraceae

112.3136—DROSERA BURMANNII Vahl.

Hainan, Tai Wan, San Hu (海南.大環,新墟), 7758, 8993, Apr. 12, 1922; on moist hillside in clay soil; alt., 30 m.; herb; fls., yellow, red; lvs., reddish, carniverous; name reported, *U ying ts'o* (烏蠅草).

112.3136—DROSERA INDICA Linn.

Nodoa (那大), 7709, 8252**, Oct. 30, 1921 and *Tai Wan, San Hu* (大環新墟), 8939, 8252**, Apr. 10, 1922; in sand near and in the water along river; ht., 15 m.; fls., pink; branches covered with sticky hairs which enable it to catch insects; name reported, *U ying ts'o* (烏蠅草).

115—Crassulaceae

115.3165—BRYOPHYLLUM PINNATUM (Lam.) Kurz.

Hainan, Ting On River (海南,定安河), 8865, Apr. 6, 1922; shady waste places; alt., 40 m.; ht., 2/3 m.; fls., green and red; drug plant; leaves take root if they come in contact with moist earth; name reported, *Lok ti shang kan* (落地生根).

117—Saxifragaceae

117.3220—DICHROA FEBRIFUGA Lour.

Nodoa, Sha Po Ling (那大,沙煲嶺), 8154, Nov. 10, 1921, *Hainan, Fan Ta* (海南,番打), 9143, Apr. 18, 1922 and *Five Finger Mt.*, (五指嶺), 9588, May 14, 1922; mt. side thicket, near small stream in shade, in heavy wooded ravine; shrub; ht., 1-4 m.; fls., white; frs., bright blue berries.

117.3220—DICHROA MOLLISSIMA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 245

Five Finger Mt., (五指嶺), 9373, Apr. 29, 1922; wooded ravine; ht., 1½ m.; fls., blue; frs., blue.

117.3231—ITEA MACROPHYLLA Wall.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7816, Nov. 2, 1922 and *Hainan, T'a Hon Nga Wan* (海南,他寒-牙環), 9226, Apr. 22, 1922; ravine, along stream; alt., 300 m.; shrub; ht., 4-6 m.; dia., 10 cm.; fls., yellow, white.

117.3240—POLYOSMA INTEGRIFOLIA Blume

Five Finger Mt., (五指嶺), 9366, Apr. 29, 1922; wooded ravine; tree; ht., 12 m.; dia., 25 cm.

118—Pittosporaceae

118.3252—PITTOSPORUM FERRUGINEUM Ait.

Hainan, Tai Wan, San Hu (海南,大環,新墟), 8955, Apr. 10, 1922, *Hainan, W. of Notia* (海南,和舍之西), 8964, Apr. 11, 1922; in shrubby waste land; ht., 1-1½ m.; fls., white.

118.3252—PITTOSPORUM FORMOSANUM Hayata var.
HAINANENSE Gagnep.

Hoihow (海口), 7612, Oct. 10, 1921; Bamboo thicket; tree; ht., 6 m.; dia., 12 cm.; frs., red.

118.3252—PITTOSPORUM PAUCIFLORUM H. & A.

Tai Un (大園), 7845, Oct. 27, 1921, *Five Finger Mt.*, (五指嶺), 8584, Dec. 21, 1921; roadside climbing on shrubs, mt. side forest; alt., 750 m.; shrub; ht., 2 m.; dia., 5 cm; frs., pod green with red seed.

123—Hamamelidaceae

123 3298—LIQUIDAMBAR FORMOSANA Hance

Kam Kong (金江), 7700, Oct. 26. 1921, *Hainan, Yik Tsok Mau* (海南,赤作茂), 9354, May 17, 1922; waste land, on open hillside; alt., 250 m.; tree; ht., 7-15 m.; dia., 40 cm.; fls., green; name reported, *Fung shu* (楓樹).

126—Rosaceae

126.3339—RHAPHIOLEPIS INDICA (Linn.) Lindl.

Kam Kong (金江), 7682, Oct. 26, 1921; roadside; bush; ht., 2 m.; frs., black.

126.3339—RHAPHIOLEPIS PARVIBRACTEOLATA Merr. SP. NOV.
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Nodoa (那大), 8015, Jan. 2, 1922; roadside in wilderness; alt., 250 m.; shrub; ht., 2½ m. fls., white very fragrant.

126.3344—STRANVAESIA BENTHAMIANA (Hance) Merr.

Nga Wan (牙環), 8348, Dec. 6, 1921 and *Hainan, Shui Mun* (海南,水門) 9594, May 14, 1922; hillside; alt., 650 m.; ht., 5 m.; dia., 10 cm.; tree; frs., black.

126.3353—RUBUS COCHINCHINENSIS Tratt.
(R. PLAYFAIRII Hemsl.)

Five Finger Mt., (五指嶺), 8479, Dec. 23, 1921. *Hainan, Fan Ya* to *Yik Tsok Mau* (海南,番也至亦作茂), 9661, May 17, 1922 and *Hainan, Kachek Wong Chuk* (海南,嘉積 ?), 9789, June 1, 1922; wooded ravine, among shrubs on hillside; alt., 800 m., vine; ht., 2½-4 m.; dia., 1-1½ cm.; fls., white, covered with green calyx; frs., red, edible; name reported, *She pau lak* (蛇泡竻).

126.3353—RUBUS FIMBRIIFERUS Focke

Nodoa, Lin Fa Ling (那大,蓮花嶺), 8091, Nov. 3, 1921, *Five Finger Mt., Fan Ya Ts'un* (五指嶺,番也村), 8432, Dec. 11, 1921 and *Five Finger Mt.*, (五指嶺), 8523, Dec. 18, 1921; edge of thicket on hillside; village commons, grassy hillside; alt., 300-1000 m.; vine; ht., 1-4 m.; fls., white; frs., red, edible; name reported, *She pau lak* (蛇泡).

126.3353—RUBUS LEUCANTHUS Hance

Hainan, Fan Ya (海南,番也), 9282, Apr. 25, 1922 and 9529, May 12, 1922; among shrubs at roadside; bush; ht., 4-5 m.; dia., 1½-2 cm.; fls., white; frs., red, edible; name reported, *Mun fu tsz* (門虎子).

126.3353—RUBUS REFLEXUS Ker.

Five Finger Mt., (五指嶺), 9581, May 14, 1922; among shrubs at roadside in forest; bush; ht., 3 m.; fls., white; frs., red; name reported, *She pau lak* (蛇泡竻).

126.3355—DUCHESNEA INDICA (Linn.) Focke

Five Finger Mt., (五指嶺), 8423, Dec. 9, 1921 and 8506, Dec. 22, 1921; mt. side forest; alt., 900-1100 m.; vine; frs., red.

126.3396—PRUNUS FORDIANA Dunn?

Tai Un (大圓), 7742, Oct. 26, 1921; roadside; shrub; ht., 2 m.; fls., white.

126.3396—PRUNUS MUME S. & Z.

Five Finger Mt., Hop Lo Ts'un (五指嶺,合鑼村), 8364, Dec. 6, 1921 and *Hainan, Fan Ya* (海南,番也), 9289, Apr. 26, 1922; roadside in ravine, growing in garden; alt., 650 m.; tree; ht., 3-5 m.; dia., 10 cm.; fls., white, very fragrant, edible, frs., edible, yellow when ripe; name reported, *Mui tsz* (梅子).

126.3396—PRUNUS PERSICA Stokes

Five Finger Mt., Fan Ya Ts'un (五指嶺,番也村), 8437, Dec. 17, 1921 and *Five Finger Mt.*, (五指嶺), 8503, Dec. 22, 1921; village commons, near Lois hut on mt. side; alt., 1000 m.; tree; ht., 2 m.; fls., pink.

127—Connaraceae

127.3424—ROUREA MILLETTII Planch.

Ta Hon (他寒), 8333, Dec. 5, 1921; edge of stream; alt., 300 m.; vine; frs., yellow when ripe.

127.3434—ELLIPANTHUS GLABRIFOLIUS Merr. SP. NOV.
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Near Ka La (近加拉) 9180 Apr. 20, 1922; dry hillside; tree; ht., 7-8 m.; dia., 10 cm.; frs., brown.

128—Leguminosae

128.3441—PITHECOLOBIUM ANGULATUM Benth.

T'a Hon Ts'un (他寒村), 8340, Dec. 5, 1921, *Five Finger Mt., Fan Ya* (五指嶺番也), 8421, Dec. 9, 1921 and *Five Finger Mt.*. (五指嶺), 9405, May 3, 1922; hillside, mt. side forest; in heavily wooded ravine; alt., 375-1000 m.; bush; ht., 1-1½ m.; dia., 1½ cm.; fls., yellowish white, slightly fragrant; Lois uses the roots as medicine by steeping in water.

128.3441—PITHECOLOBIUM CLYPEARIA (Jack) Benth.

Five Finger Mt., (五指嶺), 8637, Dec. 24, 1921, *Fan Ta* (番打), 9164, Apr. 19, 1922, *Five Finger Mt.*, (五指嶺), 9590 May 14, 1922; in ravine at edge of stream; alt., 600 m.; tree; ht., 4-7 m.; dia., 10-12 cm.; fls., orange, white, fragrant; frs., seed pods reddish brown; name reported, *Niu t'ung kung* (尿桶公).

128.3441—PITHECOLOBIUM LUCIDUM Benth.

Hainan, Fan Ya (海南,番也), 9299, Apr. 26, 1922; shrub; ht., 2-3 m.; dia., 3-4 cm.; fls., white, slightly fragrant.

128.3443—ALBIZZIA CHINENSIS (Osbeck) Merr.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7916, Nov. 3, 1921; thicket; alt., 300 m.; tree; ht., 7 m.; dia., 15 cm.

128.3443—ALBIZZIA ODORATISSIMA (Linn. f.) Benth.

T'a Hon (哋寒), 7687, Oct. 27, 1921, *Pat Ka Ling* (筆架嶺), 7729, Nov. 1, 1921; edge of thicket; tree; ht., 7-8 m.; dia., 15-20 cm.

128.3443—ALBIZZIA PROCERA (Roxb.) Benth.

Nodoa, Tai Un (那大,大園), 7782, Oct. 27, 1921, *Pat Ka Ling* (筆架嶺), 7853, Nov. 1, 1921; edge of cultivated field, edge of thicket; tree; ht., 8 m.; dia., 20 cm.

128.3446—ACACIA HAINANENSIS Hayata

Fan Ya to Yik Tsok Mau (番也到亦作茂), 9659, May 17, 1922; on shrubby hillside; vine; ht., 4-5 m.; fls., yellow; frs., red, when in bud.

128.3446—ACACIA PENNATA (Linn.) Willd.

Five Finger Mt., (五指嶺), 9369, Apr. 29, 1922; wooded ravine; vine; ht, 15 m.; dia., 5 cm.; fls., browuish red.

128.3468—ENTADA PHASEOLOIDES (Linn.) Merr.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 8067, Nov. 3, 1921; side in ravine growing on trees; alt., 450 m.; vine; ht., 10 m.; name reported, *Ngau cheung ma* (牛腸蔴).

128.3508—TAMARINDUS INDICA Linn.

Nodoa, Yau Ma Wo (那大,油蔴和), 8108, Nov. 21, 1921; in garden; alt., 250 m.; tree; ht., 4 m.; dia., 10 cm.; frs., may be eaten; used by the Chinese to make sour soup: names reported, *Sun mui* (酸梅), *Sun tau* (酸荳).

128.3528—BAUHINIA CORYMBOSA Roxb.

Hainan, Kachek-Wong Chuck (海南,嘉積- ?), 9794, June 1, 1922; in uncultivated land; vine; fls., light pink, fragrant; wood of this vine is very tough and is used to make bracelets; names reported, *Shau kun t'ang* (首冠籐), *Tsung kun t'ang* (總管籐).

128.3536—CASSIA MIMOSOIDES Linn.

Tai Un (大園), 7755, Oct. 26, 1921, *Pat Ka Ling* (筆架嶺), 8032, Nov. 1, 1921, *Kam Kong* (金江), 8246, Oct. 26, 1921 and *Kingchow* (瓊州), 8834, Apr. 5, 1922; dry grassy roadside; alt., 10 m.; herb; ht., 15-20 m.; fls., yellow.

128.3536—CASSIA OCCIDENTALIS Linn.

Hoihow (海口), 7616, Oct. 9, 1921 and *Hainan, Kingchow* (海南,瓊州), 8816, 8847, Apr. 5, 1922; grave land, roadside; alt., 10-40 m.; herb; ht., 1 m.; fls., yellow; drug plant; boil the leaves with eggs good for headache; names reported, *Shan luk tau* (山綠荳), *Chu kwat min* (猪骨棉).

128.3551—PARKINSONIA ACULEATA Linn.

Nodoa (那大), 7985, Nov. 17, 1921; cultivated plant introduced from U.S.; alt., 250 m.; fls., yellow.

128.3556—DELONIX REGIA (Boj.) Raf.

Nodoa (那大), 7989, Nov. 17, 1921; Presby. Mission Compound; alt., 250 m.; tree; ht., 12 m.

128.3559—CAESALPINIA CRISTA Linn.

Hoihow (海口), 7602, Oct. 10, 1921; dry thicket; vine; ht., 20 m.; fls., yellow; name reported, *Nam she lak* (南蛇勒).

128.3559—CAESALPINIA SEPIARIA Roxb.

Nodoa (那大), 7988, Nov. 17, 1921; Presby. Mission School; alt., 250 m.; vine; ht., 7 m.; fls., yellow.

128.3597—ORMOSIA FORDIANA Oliv.

Nodoa, Sha Po Ling (那大,沙煲嶺), 8132, Nov. 10, 1921, *Five Finger Mt., Fan Ya* (五指嶺,番也), 8453, Dec. 7, 1921 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9756, May 19, 1922; mt. side thicket ravine, in partially wooded ravine; alt., 500-1000 m.; tree; ht., 5-15 m.; dia., 15 cm.; fls., lavender, fragrant; frs., red, seeds red when fresh; name reported, *Shik ch'ung shu* (食虫樹).

128.3597—ORMOSIA HAINANENSIS Gagnep.

Nodoa (那大), 7718, Oct. 28, 1921, *Five Finger Mt.*, (五指嶺), 8656, Dec. 20, 1921; thicket near village, edge of forest in clearing; alt., 250-600 m.; tree; ht., 5-10 m.; dia., 10-40 cm.; frs., yellow; name reported, *Shik ch'ung shu* (食蟲樹).

128.3597—ORMOSIA SEMICASTRATA Hance

Five Finger Mt., (五指嶺), 9809, May 1, 1922; wooded slope; tree; ht., 12 m.; dia., 15 cm.

128.3610—BOWRINGIA CALLICARPA Champ.

Hainan, Yik Tsok Mau (海南,亦作茂), 8141**, 9647, May 17, 1922; in partially wooded ravine; vine; ht., 5-6 m.; fls. white, fragrant.

128.3669—CROTALARIA CALYCINA Schrank

Nodoa (那大), 7937, Nov. 2, 1921 and 7971, Nov. 5, 1921 and *Ooi Diok* (?), 8782, Oct. 15, 1921; open grassy roadside; alt., 250 m.; shrub; fls., yellow, fragrant.

128.3669—CROTALARIA CHINENSIS Linn.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7723, Nov. 3, 1921; dry grassy open hillside; herb; fls., yellow.

128.3669—CROTALARIA FERRUGINEA Grah.

Nam Fung (南風), 7961**, 8288, Nov. 30, 1921; hillside in tall grass; alt., 300 m.; herb; fls., bright yellow; name reported, *Ka ti lam* (假地藍).

128.3669—CROTALARIA LINIFOLIA Linn. f.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7852, Nov. 1, 1921, *Sha Po Ling* (沙煲嶺), 8200, Nov. 11, 1921 and *Hainan, Kingchow* (海南,瓊州), 8830, Apr. 5, 1922; roadside, open grassy hillside; alt., 250-450 m.; ht., 10 m.; dia., 15 cm.; fls., yellow.

128.3669—CROTALARIA RETUSA Linn.

Nam Fung (南風), 7666**, 8291, Nov. 30, 1921; edge of ravine; alt., 250 m.; bush; ht., 1½ m.; drug plant.

128.3669—CROTALARIA SALTIANA Andr.

Hoihow (海口), 7580, Oct. 11, 1921 and *Ting On River* (定安河), 8908, Apr. 7, 1922; dry thicket, sandy waste; alt., 50 m.; herb; ht., 1-3 m.; fls., yellow streaked with maroon; names reported, *Tai ngan lam* (大眼藍), *Ye wong tau* (野黃荳).

128.3669—CROTALARIA SESSILIFLORA Linn.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7763, Nov. 3, 1921, *Pat Ka Ling* (筆架嶺), 7856, Nov. 1, 1921, *Lin Fa Ling* (蓮花嶺), 7968, Nov. 2, 1921; on grassy slope; alt., 350 m.; herb; fls., blue.

128.3702—INDIGOFERA GALEGOIDES DC.

Nam Fung (南風), 8285, Nov. 30, 1921; village commons; alt., 250 m.; herb; ht., 1 m.; name reported, *Ka tai tsing lam* (假大青藍).

128.3702—INDIGOFERA HIRSUTA Linn.

Hoihow (海口), 7570, Oct. 12, 1921, *Hainan, Ting On River* (海南,定安河), 8830, Apr. 6, 1922; grassy field, edge of cultivated sandy fields and in grassy wastes; alt., 40 m.; herb; fls., red, and yellow.

128.3702—INDIGOFERA TINCTORIA Linn.

Hainan, near Tai Ti P'o (海南,近 ?), 9821, Apr. 18, 1922; among shrubs at roadside; herb; fls., purple when ripe; name reported, *Lam tin* (藍靛).

128.3702—INDIGOFERA TRIFOLIATA Linn.

Hainan, Yik Tsok Mau, Nga Wan (海南,亦作茂,牙環), 9267, Apr. 23, 1922; growing on grassy hillside; fls., red; woody plant.

128.3718—TEPHROSIA PURPUREA (Linn.) Pers.

Hoihow (海口), 7654, Oct. 11, 1921, *Kam Kong* (金江), 7838, Oct. 26, 1921, *Ka La* (加拉), 8327, Dec. 4, 1921 and *Hainan, Ting On River* (海南,定安河) 8861, Apr. 6, 1921; dry roadside, grassy field, in sandy waste places; alt., 350 m.; herb; ht., ½-1 m.; fls., blue, crimson, purple; fragrant; a possible ornamental; names reported, *Ka tin tsing* (假靛青), *Ye lam tin* (野藍靛).

128.3718—TEPHROSIA VESTITA Vog.

Near Notia (近和舍), 7783, Oct. 28, 1921, thicket; herb.

128.3720—MILLETTIA DIELSIANA Harms.

Near Notia, 7779, Oct. 27, 1921; roadside; ht., 1 m.

128.3720—MILLETTIA LASIOPETALA (Hayata) Merr.
(DERRIS LASIOPETALA Hayata MILLETTIA OBOVATA Gagnep)

Nodoa, Pat Ka Ling (那大,筆架嶺), 8043, Nov. 1, 1921 and *Hainan, Fan Ya* (海南,番也), 9511, May 9, 1922 and 9527, May 10, 1922; climbing on tree in thicket, along road on shrubs; vine; ht., 3-8 m.; fls., purple; the vine is bruised and used by the Lois to poison fish.

128.3720—MILLETTIA OOSPERMA Dunn.

Ka La (加拉), 8329, Dec. 4, 1921; on tree on bank of stream; alt., 350 m.; vine; ht., 10 m.

128.3720—MILLETTIA PULCHRA (Benth.) Kurz.

Hainan, Fan Ya (海南,番也), 9634, May 15, 1922; on rocky bank of streams; shrub; ht., 2 m.; fls., lavender.

128.3720—MILLETTIA RETICULATA Benth.

Hainan, S. of Fan Ta (海南,番打之南), 9168, Apr. 19, 1922; growing prostrate among grass on open hillside; vine; ht., 5-6 m.; fls., purple; names reported, *Lo king t'ang* (老莉藤), *Kam shu t'ang* (蠄蜍藤).

128.3720—MILLETTIA SP.

Hainan (海南), 9524, May 10, 1922.

128.3796—SMITHIA SENSITIVA Ait.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7713, Oct. 30, 1921 and *Hau Lan Tong* (?), 8213, Nov. 21, 1921; roadside, edge of pond; alt., 250 m.; bush; ht., 2/3 m.; fls., yellow; leaves sensitive to touch.

128.3803—ARACHIS HYPOGAEA Linn.

Hainan, Kachek, Wong Chuk (海南,嘉積, ?), 9791, June 1, 1922; cultivated in field; vine; fls., orange yellow; the fruits are used as food and also as a source of oil in cooking and as an illuminant; name reported, *Fa shang* (花生).

128.3804—ZORNIA DIPHYLLA (Linn.) Pers.

Hainan, Ting On River (海南,定安河), 8891, Apr. 7, 1922; sandy roadside among grass; alt., 50 m ; fls., yellow.

128.3807—DESMODIUM BUERGERI Miq.
(D. HETEROCARSPUM DC.)

7736**.

128.3807—DESMODIUM CEPHALOTES Wall.

Nodoa (那大), 7707, Oct. 30, 1921 and *Pat Ka Ling, Nodoa* (筆架嶺,那大), 7859, Nov. 1, 1921; among shrubs at roadside; alt., 250 m.; bush; ht., 1 m.; fls., whitish.

128.3807—DESMODIUM ELEGANS (Lour.) Benth.

Mi Ting (美亭), 7840, Oct. 26, 1921; dry roadside; bush; ht., 1 m.

128.3807—DESMODIUM HETEROCARPUM (Linn.) DC.

Kam Kong (金江), 8248, Oct. 26, 1921; dry roadside; herb; fls., purplish lavender.

128.3807—DESMODIUM HETEROPHYLLUM (Willd.) DC.

Nodoa (那大), 7941, Oct. 31, 1921; open dry grassy places; herb; fls., blue, lavender.

128.3807—DESMODIUM LASIOCARPUM (Beauv.) DC.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7765, Nov. 1, 1921 and *Nodoa* (那大), 8033, Nov. 1, 1921; dry roadside, edge of thicket; alt., 250 m.; bush; ht., 1½ m.; fls., dark lavender.

128.3807—DESMODIUM LAXUM DC.

T'a Hon (他寒), 8334, Dec. 5, 1921; edge of stream; alt., 350 m.

128.3807—DESMODIUM MICROPHYLLUM (Willd.) DC.

Hop Lo Ts'un, Five Finger Mt., (合羅村,五指嶺), 8365, Dec. 6, 1921; in grassy hillside; alt., 800 m.; prostrate; fls., blue, turning to lavender.

128.3807—DESMODIUM RETICULATUM Champ.

Nodoa, Pat Ka Ling (那大,筆架嶺), 8039, Nov. 1, 1921; roadside; herb; ht., 1 m.

128.3807—DESMODIUM TRIQUETRUM (Linn.) DC.

On Yan (安仁), 7798, Oct. 25, 1921 and *Ting On River* (定安河), 8900, Apr. 7, 1922; in bushes at roadside, sandy waste; vine; alt., 50 m.; ht., 1-2 m.; fls., purplish red, lavender; names reported, *U lo cha* (葫蘆茶), *Ham ha ip* (鹹蝦葉), *Pak lo shit* (白勞舌).

128.3809—PYCNOSPORA NERVOSA (Grah.) W. & A.

Kam Kong (金江), 7835, Oct. 26, 1921 and *Kingchow* (瓊州), 8829, Apr. 5, 1922; dry roadside, grassy place; alt., 10 m.; prostrate; ht., 1/3-2/3 m.; fls., purplish blue, black pod.

128.3810—ALYSICARPUS NUMMULARIFOLIUS (Linn.) DC.

Nodoa (那大), 7694, Nov. 1, 1921, *Hoihow* (海口), 7636, Oct. 10, 1921, *Nodoa, Ha Kung Ling* (那大,蝦公嶺), 7822**, 8214, Nov. 2, 1921 and *Ting On River* (定安河), 8896, Apr. 7, 1922; dry roadside, near hot spring, sandy waste; alt., 250-300 m.; herb; ht., 50 m.

128.3812—URARIA CRINITA Desv.

Nodoa, Yau Ma Wo (那大,油蔴和), 7761**, 8120, Nov. 9, 1921 and *Nodoa, Sha Po Ling* (那大,沙煲嶺), 8190, Nov, 11, 1921; edge of terrace, sparse forest among grass; alt., 250-400 m.; bush; ht., 1 m.

128.3812—URARIA LAGOPODIOIDES (Linn.) D. Don.

Hainan 海南), 7760**, 9264, Apr. 23, 1922; on open grassy hillside; fls., lavender; drug plant; name reported, *U li mi* (狐狸尾).

128.3812—LOUREA OBCORDATA Desv.

Enroute to *Nga Wan, Yik Tsok Mau* (牙環,亦作茂), 7839**, 9258, Apr. 23, 1922; on dry open hillside among grass; herb; fls., lavender.

128.3821—DALBERGIA HANCEI Benth.

West of Tai Wan, San Hu (大環之西新墟), 8953, Apr. 10, 1922 and *Fan Ta* (番打), 9152, Apr. 18, 1922; in shrubby waste land, roadside among shrubs; vine; ht., 2 m.; fls., cream; names reported, *Tso kok* (皂角), *Yau heung t'ang* (油香藤).

128.3836—PONGAMIA PINNATA (Linn.) Merr.

Ting On River (定安河), 8867, Apr. 6, 1922; on bank; ht., 4-5 m.; dia., 8 cm.; fls., blue to lavender; good ornamental.

128.3838—DERRIS FERRUGINEA Benth.

Yik Tsok Mau (亦作茂), 9665, May 17, 1922; on shrubs in ravine; vine; ht., 10 m.; dia., 1½ cm.; fls., white, slightly fragrant; name reported, *Lo king t'ang* (老荆藤).

128.3838—DERRIS SP.

South of Ka La (加拉之南), 9199, Apr. 21, 1922; on trees by stream; vine; ht., 8-10 m.; fls., pink, slightly fragrant.

128.3864—GLYCINE MAX (Linn.) Merr.
(G. HISPIDA Maxim)

Ooi Diok (?), 8786, Oct. 12, 1921; cultivated field; herb.

128.3866—TERAMNUS SP.

Five Finger Mt., (五指嶺), 8590, Dec. 21, 1921; wooded mt. side; alt., 650 m.; vine; ht., 2 m.

128.3870—ERYTHRINA INDICA Lam.

Tung Shan on the Ting On River (東山在定安河), 8913, Apr. 8, 1922; alt., 50 m.; ht., 7 m.; dia., 12 cm.; fls., brilliant scarlet; a good ornamental; name reported, *Kai kung shu* (雞公樹).

128.3877—MUCUNA SP. aff. PRURIENS DC.

Nga Wan (牙環), 8350, Dec. 6, 1921; hillside on grass; alt., 650 m.; vine.

128.3877—MUCUNA HAINANENSIS Hayata (M. SUBEROSA Gagnep.)

South of Fan Ta (番打之南), 9166, Apr. 19, 1922; along stream on trees; vine; ht., 15 m.; fls., red and green-brown, pubescent.

128.3889—PUERARIA PHASEOLOIDES (Roxb.) Benth.

Tai Un (大園), 7677, Oct. 26, 1921 and *Notia* (和舍), 7770, Oct. 27, 1921; roadside on shrubs; vine; fls., blue, pink, lavender.

128.3889—PUERARIA THUNBERGIANA (S. & Z.) Benth.

Fan Ya (番也), 9633, May 15, 1922; growing on trees and shrubs; shrub; ht., 4-6 m.; fls., purplish lavender.

128.3889—PUERARIA SP.

Nodoa (那大), 7763, Nov. 1, 1921, *Nodoa, Yau Ma Wo* (那大,油蔴和), 8121, Nov. 9, 1921, *Hong Ma Ts'un* (康馬村), 8299, Dec. 3, 1921 and *Five Finger Mt., Fan Ya* (五指嶺,番也), 8396, Dec. 9, 1921; edge of thicket on shrubs; alt., 250-1000 m.; vine; fls., blue, pink, lavender.

128.3891—CANAVALIA MICROCARPA (DC.) Piper
(C. TURGIDA Grah.)

Ting On River (定安河), 8931, Apr. 9, 1922; growing on tree; alt., 70 m.; ht., 10 m.; fls., pink; drug plant; name reported, *Ye to pan tau* (野刀板荳).

218.3891—CANAVALIA ROSEA (Sw.) DC.

Hoihow (海口), 9830, Jan. 7, 1922; sand pit; fls., pink, fragrant.

128.3892—CAJANUS CAJAN (Linn.) Millsp.

Five Finger Mt., Hop Lo Ts'un (五指嶺,合羅村), 8355, Dec. 6, 1921; cultivated field; alt., 800 m.; shrub; ht., 2 m.; fls., yellow; frs., edible; name reported, *Muk tau* (木荳).

128.3894—DUNBARIA ROTUNDIFOLIA (Lour.) Merr.

Nodoa (那大), 7693, Oct. 27, 1921; dry roadside; alt., 250 m.; fls., lavender.

128.3894—DUNBARIA SUBRHOMBEA (Miq.) Hemsl.

South of Fan Ta (番打之南), 9169, Apr. 19, 1922; on shrub on hillside; vine; ht., 2 m.; fls., yellow; name reported, *Kap tsai t'ang* (鴿仔藤).

128.3895—CANTHAROSPERMUM SCARABAEOIDES (Linn.) Baill.

Nodoa (那大), 7762, Nov. 1, 1921; roadside among shrubs; alt., 250 m.; vine.

128.3898—ERIOSEMA CHINENSE Vog.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7719, Nov. 3, 1921; open grassy slope; alt., 300 m.; fls., yellow.

128.3899—FLEMINGIA MACROPHYLLA (Willd.) O. Ktz.

Fan Ya (番也), 9624, May 15, 1922; on half-forested hillside; shrub; fls., lavender.

128.3899—FLEMINGIA PHILIPPINENSIS Merr. & Rolfe

Nodoa, Pat Ka Ling (那大,筆架嶺), 8024, Oct. 28, 1921; roadside on shrubs; vine.

128.3899—FLEMINGIA STROBILIFERA (Linn.) R. Br.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7912, Nov. 3, 1921; open grassy hillside; alt., 450 m.; bush; ht., 1 m.; fls., white.

128.3901—PHASEOLUS LUNATUS Linn.

Kingchow (瓊州), 7547, Oct. 14, 1921 and *Five Finger Mt., Fan Ya* (五指嶺,番也), 8414, Dec. —, 1921; thicket, Loi garden; alt., 1000 m.; vine; fls., purple, white; frs., edible; name reported, *Min tau* (面荳).

128.3910—DOLICHOS FALCATUS Klein.

Hoihow (海口), 7555, Oct. 11, 1921 and 7601, Oct. 11, 1921 and *Tai Tsing* (大井), 7669, Oct. 24, 1921; on city wall, edge of bamboo, thicket, on shrubs at roadside among volcanic rocks; vine; ht., 1 m.; fls., pink, white, purple.

128.3910—DOLICHOS LABLAB Linn.

Five Finger Mt., Hop Lo Ts'un (五指嶺,合籮村), 8356, 8456**, Dec. 6, 1921 and *Fan Ya* (番也), 9521, May 9, 1922; in cultivated field; alt., 800 m.; ht., 1½-2 m.; fls., white; frs., edible.

130—Oxalidaceae

130.3936—OXALIS REPENS Thunb.

Kingchow (瓊州), 8849, Apr. 5, 1922; shady places; alt., 40 m.; fls., yellow; names reported, *Sun mi t'so* (酸味草), *Puk kau sun* (卜鳩酸).

137—Rutaceae

137.3990—ZANTHOXYLUM AVICENNAE (Lam.) DC.

Kingchow (瓊州), 7626, Oct. 14, 1921 and *Tin Si, San Hu* (? ,新墟), 7731, Oct. 28, 1921; dry ground, roadside; bush; ht., 2 m.; fls., white.

137.3990—ZANTHOXYLUM NITIDUM (Lam.) DC.

Hainan, Kingchow (海南,瓊州), 8841, Apr. 5, 1922; and *Hainan, Fan Ya* (海南,番也), 9305, Apr. 26, 1922; shady roadside, on shrubs and trees; alt., 10 m.; vine; ht., 3-5 m.; fls., cream, fragrant; seeds have hot taste and are used to stupefy fish; name reported, *Shan u tsiu* (山葫椒).

137.3993—EVODIA HAINANENSIS Merr. SP. NOV.
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Five Finger Mt., Fan Ya (五指嶺,番也), 8449, Dec. 7, 1921; hillside; alt., 1000 m.; tree; ht., 4 m.; dia., 10 cm.; Loi use-for swollen limbs, rub fresh leaves on affected part; name reported, *Ngau kau shu* (牛糾樹).

137.3993—EVODIA MELIAEFOLIA (Hance) Benth.

Tai Tsing (大井), 7751, Oct. 24, 1921; roadside; tree; ht., 7 m.; name reported, *Ch'at shu* (察樹).

137.3993—EVODIA PTELEAEFOLIA (Champ.) Merr.

Nodoa, Yau Ma Wo (那大,油蔴和), 8109, Nov. 9, 1921, *Ting On River, Hainan* (定安河,海南), 8919, Apr. 8, 1922, below cave *S. slope of Five Finger Mt.*, wooded ravine (五指嶺), 9321, Apr. 28, 1922, *Hainan, Yik Tsok Mau* (海南,亦作茂), 9649, May 17, 1922 and *Hainan, Enroute Fan Ya* (海南,番也), 9650, May 17, 1922; in scanty growth of trees in waste land, wooded ravine, open hillside, along path in edge of thicket; alt., 60-250 m.; tree; ht., 1½-5 m.: dia., 1-10 cm.; fls., white, fragrant; ornamental; name reported, *Sam a fu* (三椏苦).

137.4077—TODDALIA ASIATICA (Lam.) Kurz

Nodoa (那大), 7953, Nov. 9, 1921 *Hainan, Enroute Kachek, Wong Chuk* (海南, ?), 9800, June 1, 1922; roadside on shrubs; alt., 250 m.; vine; ht., 4-5 m.; fls., greenish; frs., yellow when ripe; the leaves have a pungent odor when crushed; seeds used by natives as a condiment in cooking; names reported, *Shan u tsiu kung* (山葫椒公), *Lak kau* (竻鈎).

137.4079—ACRONYCHIA OLIGOPHLEBIA Merr. SP. NOV.
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Hainan, S. slope of Five Finger Mt., (海南,五指嶺之南麓), 9496, May 9, 1922; in wooded ravine; tree; ht., 7 m.; dia., 10 cm.; fls., yellow and green, fragrant.

137.4079—ACRONYCHIA PEDUNCULATA (Linn.) Miq.

Tai Un (大園), 7732, Oct. 27, 1921, *Nodoa* (那大), 7958 Nov. 9, 1921, *Five Finger Mt.*, (五指嶺), 8483, Dec. 23, 1921, *Hainan, near Tin Si* (海南), 8972, Apr. 11, 1922, *Hainan, Yik Tsok Mau* (海南,亦作茂), 9711, May 18, 1922 and *Hainan, enroute Kachek, Wong Chuk* (海南, ?), 9780, June 1, 1922; village commons, wooded ravine, in waste land, grassy country at roadside; alt., 250-800 m.; shrub; ht., 2½-7 m.; dia., 1-12 cm.; fls., white, cream, yellow, fragrant; frs., yellowish white; names reported, *Shan yau kom* (山油柑), *Shan kom* (山柑).

137.4083—SKIMMIA JAPONICA Thunb.

Hainan, near summit of Five Finger Mt., (南海,近五指嶺頂), 9390, and 9395, May 1, 1922; on rocky bank, on rock cliff; bush; ht., 1½-2 m.

137.4087—GLYCOSMIS PENTAPHYLLA (Retz.) Corr.
(G. COCHINCHINENSIS Pierre)

Hoihow (海口), 7539, Oct. 11, 1921, *Hong Ma Ts'un* (康馬村), 8314, Dec. 3, 1921, *Five Finger Mt.*, (五指嶺), 8494, Dec. 23, 1921, *Five Finger Mt.*, (五指嶺), 8553, Dec. 20, 1921, *Hainan, Kingchow* (海南,瓊州), 8848, Apr. 5, 1922, *Hainan, Shui Mun* (海南,水門), 9702, May 15, 1922 and *Hainan, enroute Kachek* (海南, ?), 9787, June 1, 1922: in thicket near village, wooded ravine, moist shady ravine on rock, grassy place, roadside; alt., 400-900 m.; bush; ht., 2/3-3 m.; dia., 4 cm.; fls., white, fragrant; frs., salmon pink, golden yellow when ripe: leaves used in making "rice wine cakes"; names reported, *Tsau ping ip* (酒餅葉), *Shan kat* (山桔).

137.4090—MICROMELUM MINUTUM (Forst.) Seem.

Nodoa (那大), 7772, Oct. 28, 1921, *Pat Ka Ling, Nodoa* (筆架嶺,那大), 7902, Nov. 1, 1921, *Fan Ta, Nam Fung* (番打,南風), 8260, Dec. 30, 1921, *Hainan, Kingchow* (海南,瓊州), 8823, Apr. 5, 1922 and *Hainan, W. of Notia* (海南,和舍之西), 8966, Apr. 11, 1922; near stream, edge of thicket, roadside, waste place; alt., 10-300 m.; shrub; ht., 1-2 m.; fls., yellowish white, fragrant; frs., yellow, red; leaves used to make cakes which are used in fermenting rice for whiskey; names reported, *Tai kon* (大桿), *Tai kun* (大管).

137.4091—CLAUSENA EXCAVATA Burm. f.

Hainan, Yik Tsok Mau (海南,亦作茂), 9735, May 19, 1922; in wooded ravine; tree; ht., 12 m.; dia., 18 cm.; fls., yellow.

137.4091—CLAUSENA LANSIUM (Lour.) Skeels

Hainan, Fan Ya (海南,番也), 9605, May 14, 1922; village commons; tree; ht., 10 m.; dia., 25 cm.; name reported, *Wong p'i* (黄皮).

137.4091—CLAUSENA MONINGERAE SP. NOV.
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Hainan, Kingchow (海南,瓊州), 8803, Apr. 5, 1922 and *Hainan, near Tai Wan, San Hu* (海南,近大環,新墟), 8995, Apr. 9, 1922; along road, roadside-dry soil; alt., 10 m.; ht., 1-7 m.; dia., 15 cm.; fls., white with yellow center; drug plant; names reported, *Ka wong p'i* (假黄皮), *Tang lung shu* (燈籠樹), *Kai tan wong* (雞蛋黄).

137.4092—LIMONIA ACIDISSIMA Linn.

Hoihow (海口), 7611, Oct. 11, 1921 and 7671, Oct. 10, 1921; edge of beach; bush; ht., 2 m.

137.4093—LUVUNGA SCANDENS Ham.

Five Finger Mt., Yik Tsok Mau (五指嶺,亦作茂), 8470, Dec. 8, 1921 and *Five Finger Mt.*, (五指嶺), 8613, Dec. 23, 1921; wooded ravine; alt., 600-650 m.; bush; ht., 1½-7 m.; dia., 2 cm.; frs., yellow.

137.4096—ATALANTIA BUXIFOLIA (Benth.) Oliver

Hoihow (海口), 7576, Oct. 11, 1921, *Tai Un* (大園), 7825, Oct. 26, 1921, *Nodoa, Pat Ka Ling* (那大,筆架嶺), 8021, Oct. 28, 1921 and *Hainan, enroute Wong Chuk, Tung Ngai* (海南, ? ,東崖之路側), 9803, June 2, 1922; shady roadside, open, dry shrubby places; alt., 250 m.; bush; ht., 1-12 m.; dia., 3 cm., fls., white; frs., blue black when ripe; leaves used in making "wine cakes"; names reported, *Tsau ping lak* (酒餅竻), *Shan kat* (山桔), *Kau kwat lak* (狗骨竻).

137.4096—ATALANTIA SP.

Nodoa (那大), 7981, Nov. 15, 1921; roadside; alt., 250 m.; shrub; ht., 3 m.; frs., yellow when ripe; names reported, *Ye kat* (野桔), *Shan kat* (山桔).

137.4100—CITRUS AURANTIFOLIUM (Christm.) Swingle

Nodoa, San Ts'un (那大,新村), 7999, Nov. 15, 1921, *Nodoa, San Ts'un* (那大,新村), 8006, Nov. 15, 1921, *Nodoa* (那大), 8009, *Hainan, near Mai Ye* (海南, ?), 8987, Apr. 12, 1922, *Hainan, San Ts'un, near Nodoa* (海南,新村,近那大), 8996, Apr. 15, 1922, 9449, May 5, 1922, *Hainan, near Shek Pik* (海南,近石壁), 9769, May, 1922 and *Hainan, N. W. of Nodoa* (海南,那大之西北), 9817, Apr. 15, 1922; village commons at edge of thicket, door yard, waste land, growing among shrubs in cultivated hilly land; alt., 250 m.; tree; ht., 1-5 m.; dia., 2-10 cm.; fls., lavender when in bud, white after; frs., reddish yellow when ripe and very sour; names reported; *Shan kat* (山桔), *Chau shi kat* (臭屎桔), *Chu sha kat* (硃砂桔), *Kam kat* (金桔), *Heung mung* (香檬), *Kat tsai* (桔仔), *Fan kat* (番桔).

137.4100—CITRUS AURANTIUM Linn.

Nodoa (那大), 8013; cultivated in sandy field; alt., 250 m.; tree; ht., 3 m.; dia., 6 cm.; fls., white, fragrant; frs., yellow, green when ripe; the skin is very thin and the fibrous part of the flesh is very slight, the fruit is juicy and sweet and sometimes reaches the size of 1 lb., one tree bore 350 fruits this year; name reported, *Shek shing ch'ang* (石城橙).

137.4100—CITRUS MAXIMA (Burm.) Merr.

Hainan, Nga Wan (海南,牙環), 9257, Apr. 23, 1922; in village commons; tree; ht., 5 m.; dia., 10 cm.; fls., white, very fragrant; frs., very bitter, but the Lois say they eat them; leaves used by Lois for headache; leaves warmed by fire and applied to temples and forehead; name reported; *Yau* (柚)

137.4100—CITRUS MEDICA Linn.

Nodoa, Ma Ye (那大, ?), 7998, Nov. 15, 1921, *Nodoa, Yau Ma Wo* (那大,油蔴和), 8127, Nov. 11, 1921 and *Hainan, at Fan Ta* 海南,在番打 9151, Apr. 18, 1922; in cultivated shrubby ground, village commons; alt., 250 m.; tree; ht., 2-3½ m.; dia., 5-10 cm.; fls., white with tinge of lavender, reddish lavender; frs., light yellow when ripe; fruits used by the Hainanese to make candy, skin, rind and flesh all being used sliced in thin slices and candied; names reported, *Ning mung* (檸檬), *Heung un* (香橼), *Heung wong* (香黃).

McClure collected economic specimen of this, C. C. C. No. 139 (McClure Ec. No. 25).

137.4100—CITRUS SP.

Hainan, S. slope of Five Finger Mt., (海南,五指嶺之南麓), 9437, May 4, 1922 and *Hainan, S. slope of FiveFinger Mt.*, (海南,五指嶺之南麓), 9449, May 5, 1922; heavily wooded region; shrub; ht., 1½ m.; fls., white; frs., reddish orange; said by Lois to be very sweet, altho I question their sense of comparision; names reported, *Shan kat* (山桔), *Kam kat* (金桔).

138—Simarubaceae

138.4117—HARRISONIA PERFORATA (Blanco.) Merr.

On Yan (安仁), 7882, Oct. 25, 1921 and *Nodoa* (那大), 7898, Oct. 31, 1921 and *Hainan, enroute T'a Hon, Nga Wan* (海南,在他寒,牙環之道側), 9249, Apr. 22, 1922; roadside among bushes, edge of thicket, growing on shrubs; vine; ht., 2 4 m.; name reported, *Ngau kan kwo* (牛筋菓).

138.4120—BRUCEA AMARISSIMA (Lour.) Merr.

Hoihow (海口), 7598, Oct. 10, 1921, *Nodoa, Pat Ka Ling* (那大,筆架嶺), 8018, Oct. 28, 1921 and *Hainan, Kingchow* (海南,瓊州), 8824, Apr. 5, 1922; thicket, along roadside; alt., 10-250 m.; ht., 1½-2 m.; fls., greenish, unpleasant odor; frs., purple red, black purple; said by natives to be deadly poison, used as drug plant in treatment of sores on animals; names reported, *A tam tsz* (鵶膽子), *Lo a tam* (老鵶膽).

Economic specimen of this secured by E. H. Groff on the Canton market under name of *Lo a tam* (老鵶膽), C. C. C. Ec. No. 140. The price is about $3.20 L. S. per catty or one and one third pounds. It is cultivated, but the largest supply comes from the mountains. It is considered very poisonous by the Cantonese and is used to put on sores. It is also used for diarrhoea. The outer covering of the seed is removed and the inner portion pressed on brown or blotting paper until all the oil is removed (the oil is said to be the poisonous portion) when two of these seeds are taken.

140—Meliaceae

140.4171—TURRAEA PUBESCENS Hellen.

T'a Hon to Nga Wan (他寒至牙環), 9253, Apr. 22, 1922; hillside among shrubs; shrub; ht., 1½ m.

140.4175—MELIA AZEDARACH Linn.

Nodoa, San Ts'un (那大新村), 8008, Nov. 15, 1921 and *Ka Tsik* (嘉積), 9774, May 1922; village commons; alt., 250 m.; tree; ht., 8 m.; dia., 20-25 cm.; names reported, *Fu lin shu* (苦楝樹), *Sham shu* (森樹).

McClure reported, "The wood of this tree is used in Hainan for furniture, flooring, and inside finishing in houses. It takes a good finish but will not stand water well. It is found commonly distributed through-out the northern and eastern parts of Hainan. It is the wood used most commonly in Canton for making sandals." McClure collected an economic specimen of this wood, C. C. C. Ec. No. 141 (McClure Ec. No. 56). *Khou Lai* (苦楝), called in Cantonese *Fu lin* (苦楝). This is commonly known at Canton as *Sham muk* (森木). It attains a size of 3 ft. in diameter.

140.4176—AZADIRACHTA INDICA Juss.

Yik Tsok Mau (亦作茂), 9747, May 19, 1922; tree; ht., 8-15 m.; dia., 30-50 cm.; wood used for boards in making boats, also for coffins; sample of wood secured C. C. C. Ec. No. 172 (McClure Ec. No. 89) name reported, *Heung ch'un* (香椿).

140.4179—DYSOXYLUM LUKII Merr. SP. NOV.
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South of Ka La (加拉之南部), 9196, Apr. 21, 1922; on rock bank of stream; tree; ht., 4-5 m.; fls., fragrant.

140.4179—DYSOXYLUM SP.

Five Finger Mt., (五指嶺), 8570, Dec. 12, 1921; wooded ravine; alt., 1300 m.; tree; ht., 10 m.; dia., 20 cm.; frs., pod red to orange; the wood of this tree is valuable on account of its hardness.

140.4185—APHANAMIXIS ROHITUKA (W. & A.) Pierre

Kingchow (瓊州), 7548, Oct. 14, 1921, *Tai Tsing* (大井), 7672, Oct. 24, 1921; *Notia* (和舍), 8243, Oct. 28, 1921; *Fan Ya* (番也), 9306, Apr. 26, 1922; roadside, in old fruit plantation, volcanic rock and soil, in thicket; tree; ht., 5-10 m.; dia., 10-25 cm.; fls., yellow and red; frs., yellow.

140.4189—AGLAIA ROXBURGHIANA Miq.

Five Finger Mt., (五指嶺), 8560, Dec. 20, 1921; wooded mt. side; alt., 700 m.; tree; ht., 5 m.; dia., 7 cm.; frs., red when ripe, edible; Loi name "Sai hin".

140.4189—AGLAIA TETRAPETALA Pierre.

Enroute Fan Lun to Ka La (番掄至加拉之道側), 9177, Apr. 20, 1922; along stream; tree; ht., 10 m.; dia., 25 cm.; fls., slight tan or slightly pink; seeds brick red; my guide says that the farmers use the leaves as green manure on their field; name reported, *Sha lo tsz* (沙羅子).

140.4189—AGALAIA SP.?

Yik Tsok Mau (亦作茂), 9670, May 18, 1922 and 9750, May 19, 1922; wooded ravine; tree; ht., 7-15 m.; dia., 10 to 50 cm.; frs., yellow when ripe, edible; wood used in making cargo boat boards, sample of wood secured C. C. C. Ec. No. 142 (McClure Ec. No. 93); red, light in weight; name reported, *Hung lo* (紅羅).

140.4192—HEYNEA TRIJUGA Roxb. var. MICROCARPA Pierre

Nodoa, Sha Po Ling (那大,沙嫛嶺), 8145, Nov. 10, 1921, *West of Tai Wan, San Hu* (大環之西,新墟), 8949, Apr. 10, 1922 and *near Fan Ya* (近番也), 9622, May 15, 1922; thicket, in shrubby waste land, on partially wooded hillside; tree; ht., 6-12 m.; dia, 15-20 cm.; frs., red; name reported, *Ap kung t'sing* (鴨公青).

140.4192—HEYNEA SP.

Near Notia (近和舍), 7846, Oct. 27, 1921; dry roadside; shrub; ht., 2 m.

141—Malpighiaceae

141.4208—HIPTAGE MADABLOTA Gaertn.

Ka La, T'a Hon (加拉,他寒), 9211, Apr. 21, 1922; along stream in wooded ravine; shrub; ht., 1-1½ m.

145—Polygalaceae

145.4273—POLYGALA GLOMERATA Lour.

Nodoa (那大), 7966, Nov. 2, 1921; dry grassy ground.

145.4275—SECURIDACA TAVOYANA Wall.

T'a Hon (他寒), 8341, Dec. 5, 1921; edge of stream; alt., 350 m.; vine half self-supporting.

145.4281—XANTHOPHYLLUM RACEMOSUM Chod.

South slope of Five Finger Mt., (五指嶺之南麓), 9421, May 4, 1922 and 9440, May 5, 1922; wooded ravine; tree; ht., 10-12 m.; dia., 20 cm.; frs., green.

146—Dichapetalaceae

146.4283—DICHAPETALUM SP.

South of Ka La (加拉之南部), 9205, Apr. 21, 1922; along stream on shrubs; vine; ht., 3-4 m., dia., 2 cm.; fls., pink, brown when ripe.

147—Euphorbiaceae

147.4298—FLUGGEA VIROSA (Willd.) Baill.

Pat Ka Ling (筆架嶺), 7848, Nov. 1, 1921 and *near Fan Ya* (近番也), 9628, May 15, 1922; roadside, growing in clump of shrubs and vines in ravine; shrub; ht., 2-4 m.; fls., yellow; frs., white.

147.4299—PHYLLANTHUS EMBLICA Linn.

Lin Fa Ling (蓮花嶺), 7702, Nov. 4, 1921 and *Yik Tsok Mau* (亦作茂), 9742, May 19, 1922; open grassy mt. side; alt., 350 m.; tree; ht., 4-5 m.; dia., 10-15 cm.; fls., white; frs., green; names reported, *Yau kom tsz* (油柑子), Fruits used by the Chinese to make candy.

147.4299—PHYLLANTHUS MICROCARPA (Benth.) Muell.—Arg.
(P. RETICULATUS Auctt. P.P.)

Nodoa, Lin Fa Ling (那大,蓮花嶺), 8078, Nov. 3, 1921; roadside on tree; alt., 250 m.; vine; ht., 5 m.; frs., pink.

147.4299—PHYLLANTHUS NIRURI Linn.

Ting On River (定安河), 8890, Apr. 7, 1922; sandy waste; alt., 50 m.; drug plant (for rash); names reported, *Pa pui ts'oi* (霸貝菜).

Economic specimen of this secured on the Canton market by E. H. Groff, C. C. C. Ec. No. 143, under the name of *Pa pui ts'oi* (霸貝菜). It is said to come from the mts. of Kwangtung as well as Hainan. It is used to make a tea which is good for cough and to remove phlegm from the throat.

147.4299—PHYLLANTHUS PARVIFOLIUS Ham.

Ting On River (定安河), 8881, Apr. 7, 1922 and *South slope of Five Finger Mt.*, (五指嶺之南麓), 9580, May 14, 1922; on rocky bank near water; alt., 40 m.; shrub; ht., ½-2/3 m.; fls., white.

147.4299—PHYLLANTHUS SP.

Nodoa, Yau Ma Wo (那大,油蔴和), 8114, Nov. 9, 1921; on rocks at edge of water; bush alt., 250 m.; ht., 2/3 m.

147.4302—GLOCHIDION BREYNIOIDES C. B. Rob.

Fan Ta (番打), 9165, Apr. 19, 1922; along stream; shrub; ht,, 2-2½ m.; fls., reddish.

147.4302—GLOCHIDION COCCINEUM Muell.—Arg.

Hainan (海南), 8561, Dec. 20, 1921 and *Yik Tsok Mau* (亦作茂), 9744, May 19, 1922; open mountain side, grassy hillside; alt., 600 m.; tree; ht., 3-4 m.; dia., 6-7cm.; fls., greenish yellow.

147.4302—GLOCHIDION MACROPHYLLUM Benth.

Nodoa (那大), 7759, Oct. 1, 1921 and 8973, Apr. 11, 1922; bank of stream; alt., 250 m.; bush; ht., 1-2 m.; fls., cream; the bark of this plant is used to make a red pigment which is used by the natives to dye cloth; the bark also yields a glue; names reported, *Ngai kau shu* (艾膠樹), *Kwo hop tsai* (菓盒仔).

147.4303—BREYNIA FRUTICOSA (Linn.) Hook. f.

Tai Un (大園), 7679, Oct. 20, 1921 and *West of Notia* (和舍西部), 8968, Apr. 11, 1922; edge of thicket, in waste land; bush; ht., 1-1½ m.; fls., cream, greenish white; names reported, *T'in lo p'i* (田螺皮), *Hak min shan* (黑面神).

147.4303—BREYNIA ROSTRATA Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8156, Dec. 22, 1921 and 9582, May 14, 1922; wooded ravine; alt., 900 m.; tree; ht., 3-5 m.; dia., 3-10 cm.; fls., green.

147.4323—APOROSA LEPTOSTACHYA Benth.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 8050, Nov. 2, 1921 and *Notia* (和舍), 8237, June 2, 1922 and 8977, Apr. 11, 1922; roadside, in waste land; alt., 250 m.; shrub; ht., 1½-2 m.; fls., whitish; names reported, *Ngan chai* (銀柴), *Chim mai ch'ik* (粘米赤), *Ngang im shu* (硬鹽樹).

147.4324—BACCAUREA CAULIFLORA Lour.

Yik Tsok Mau (亦作茂), 9673, May 18, 1922; wooded ravine; tree; ht., 5-6 m.; dia., 10 cm.; frs., reddish yellow when ripe; borne in clusters on trunk of tree; frs., edible; name reported, *Shan wong p'i* (山黄皮).

147.4327—ANTIDESMA GHAESEMBILLA Gaertn.

Pat Ka Ling, (*Nodoa*) (筆架嶺,(那大), 7854, Nov. 1, 1921 and *Sha Po Ling* (沙煲嶺), 8152, Nov. 10, 1921; edge of thicket; alt., 250-650 m.; shrub; ht., 3 m.; dia., 8 cm.; frs., red.

147.4327—ANTIDESMA HAINANENSIS Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8702, Dec. 20, 1921; wooded m't. side; alt., 700 m.; ht., 1½ m.; frs., black.

147.4327—ANTIDESMA HENRYI Hemsl.

Five Finger Mt., *Fan Ya* (五指嶺,番也), 8378, Dec. 10, 1921, 8452, Dec. 7, 1921, 8476, Dec. 17, 1921 and 8644, Dec. 24, 1921 *West of Tai Wan, San Hu* (大環,新墟之西), 8946, Apr. 10, 1922, *West of Notia* (和舍之西部), 8980, Apr. 11, 1922, *Fan Ya* (番也), 9302, Apr. 26, 1922 and *Yik Tsok Mau* (亦作茂), 9646 May 17, 1922; hillside near village, wooded ravine on tree, in shrubby waste land, in thicket of shrubs; alt, 600-1000 m.; shrub; ht., 2/3-4 m.; dia., 1½-2 cm.; fls., brownish yellow, white, greenish yellow; frs., purple; the Lois bruise the leaves, mix with sour vine, heat and apply to bruise to clear up the blood there; name reported, *Ng ut ch'a* (五月茶).

147.4327—ANTIDESMA MACLUREI SP. NOV.
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South slope of Five Finger Mt., (五指嶺之南麓), 9551, May 13, 1922. in forest; tree; ht., 5 m.; dia., 12 cm.; fr., immature.

147.4327—ANTIDESMA SP.

Near Fan Ya (近番也), 9539, May 12, 1922; among second growth on hillside; tree; ht., 6 m.; dia., 15 cm.; fls., greenish yellow.

147.4337—BISCHOFIA JAVANICA Blume.

Tai Tsing (大井), 7892, Oct. 24, 1921, *Five Finger Mt.*, (五指嶺), 8587, Dec. 21, 1921 and *Yik Tsok Mau* (亦作茂), 9741, May 19, 1922; dry roadside, wooded ravine, grassy hillside; alt., 700 m.; tree; ht., 8-15 m.; dia., 25-45 cm.; the wood of this tree is used by the Lois in building and for coffins; names reported, *Ts'au fung shu* (秋楓樹), *Shui ka* (水加).

McClure secured an economic specimen of this wood in Hainan, C. C. C. Ec. No. 144 (McClure Ec. No. 90). It is known at Canton as *Tsau fung shu* (秋楓樹).

147.4343—CLEISTANTHUS SAICHIKII Merr. SP. NOV.
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Fan Ya (番也), 9148, Apr. 18, 1922; in thicket; tree; ht., 3-4 m.; dia., 8 cm.; fls., greenish with yellow center; name reported, *Yeung kok shu* (羊角樹).

147.4335—BRIDELIA BALANSAE Tutcher.

Lin Fa Ling (蓮花嶺), 8101, Nov. 4, 1921, *Five Finger Mt.*, (五指嶺), 8386, Dec. 10, 1921 8535. Dec. 18, 1921 and *Yik Tsok Mau* (亦作茂), 9679, May 18, 1922, 9729, May 19, 1922; moist shady ravine, edge of mt. stream, wooded ravine; alt., 450-1000 m.; tree; ht., 3-10 m.; dia., 12-20 cm.; fls., greenish yellow; frs., brownish red; fruits edible.

147.4345—BRIDELIA MONOICA (Lour.) Merr.
(B. TOMENTOSA Blume)

Nodoa (那大), 7974, Nov. 15, 1921; roadside; alt., 250 m.: tree; ht., 5 m.; dia., 10 cm.; fls., yellow; name reported, *Pik pak tsz* (逼迫子).

147.4348—CROTON TIGLIUM Linn.

Ting On River (定安河), 8864, Apr. 6, 1922 and 8927, Apr. 9, 1922; sandy bank in thicket, planted in sandy grassy land; alt., 40 m.; ht., 2-4 m.; dia., 8 cm.; fls., yellow, white; seeds used to stupefy fish in streams and ponds so they can be caught easily; the plant is half cultivated and half wild.

Economic specimen collected McClure, C. C. C. Ec. No. 145 (McClure Ec. No. 112); name reported, *Mang tsz yan* (猛子仁).

147.4366—CLAOXYLON POLOT (Burm.) Merr.
(C. INDICUM Hassk.)

Hoihow (海口), 7624, Oct. 10, 1921; *Kam Kong* (金江), 7896, Oct. 26, 1921, *Nodoa* (那大), 7982, Nov. 15, 1921, *Kingchow* (瓊州), 8846, Apr. 5, 1922 and *Ting On River* (定安河) 8929, Apr. 9, 1922; door yard, common by roadside, sandy waste; alt., 30 m.; shrub; ht., 2-5 m.; dia., 10-12 cm.; fls., green, yellowish white; drug plant; names reported, *Siu liu pang* (消了膨), *Pak t'ung shu* (白桐樹).

147.4384—TREWIA NUDIFLORA Linn.

Near Shun Ngai on the Ting On River (近船崖在定安河), 8884, Apr. 7, 1922; *North of Fan Ta* (番打之北部), 9145, Apr. 18, 1922; on sandy waste, on open hillside; alt., 50 m.; tree; ht., 4-9 m.; dia., 10 cm.

147.4385—MALLOTUS APELTA (Lour.) Muell.—Arg.

Hoihow (海口), 7538, Oct. 10, 1921, *Kingchow* (瓊州), 8817, Apr. 5, 1922, *Fan Ya* (番也), 9283, Apr. 25, 1922 and 9623, May 15, 1922; thicket, roadside, open hillside; alt., 10 m.; shrub; ht., $1\frac{1}{2}$-6 m.; dia., 8 cm.; fls., yellowish green, white; drug plant; mix leaves with *Noh mai* (glutinous rice) an use as salve for itchy rash; inner bark may be used to make string; sample secured; names reported, *Pak pui ip* (白背葉).

147.4385—MALLOTUS HOOKERIANUS (Seem.) Muell.—Arg.

Yik Tsok Mau (亦作茂), 9678, May 18, 1922; growing on large tree in wooded ravine; vine; ht., 5 m.; dia., 5-6 cm.; fls., red, yellow.

147.4385—MALLOTUS MACLUREI Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8558, Dec. 20, 1921, *South of Ka La* (加拉之南部), 9198, Apr. 21, 1922, *Yik Tsok Mau* (亦作茂), 9645, May 17, 1922, 9658, May 17, 1922, 9700, May 18, 1922, and 9701, May 18, 1922; wooded ravine, on bank of stream; alt., 600 m.; shrub; ht., 2/3-3 m.; dia., 5-8 cm.; fls., maroon, yellowish green, white, red, fragrant.

147.4385—MALLOTUS PANICULATUS (Lam.) Muell.—Arg.

Nodoa, Heung Ling (那大, ?), 8208, Nov. 21, 1921 and *Notia* (和舍), 8239, Oct. 27, 1921; in thicket; alt., 250-300 m; tree; ht., 4-5 m.; dia. 12 cm.; fls., brownish; name reported, *Pak pui shu* (白背樹).

147.4385—MALLOTUS PHILIPPENSIS (Lam.) Muell.—Arg.

Near Notia (近和舍), 7676, Oct. 27, 1921 and *Nodoa* (那大), 8988, Apr. 12, 1922; edge of thicket, well drained clay soil; tree; ht., 5-8 m.; dia., 25 cm.; fls., brownish white, cream; frs., red to brown.

147.4385—MALLOTUS REPANDUS Muell.—Arg.

Kachek, Wong Chuk (嘉積, ?), 9790, June 1, 1922; among shrubs at roadside; vine; ht., 4-5 m.; dia., 1-2 cm.; fls., brownish yellow; frs., brownish yellow.

147.4388—ALCHORNEA RUGOSA (Lour.) Muell.—Arg.

West of Tai Wan, San Hu (大環,新墟之西), 8948, Apr. 10, 1922; in waste land; ht., 1 m.; name reported, *Sam nim lau* (三稔蒟).

147.4388—ALCHORNEA SP.

Hong Ma Ts'un (康馬村), 8298, Dec. 3, 1921; thicket near village; alt., 400 m.; shrub; ht., $1\frac{1}{2}$ m.

147.4460—MACARANGA DENTICULATA (Blume) Muell.—Arg.

Hainan, Fan Ya (海南,番也), 9294, Apr. 26, 1922, *Five Finger Mt.*, (五指嶺), 9567, May 13, 1922 and *Fan Ya* to *Yik Tsok Mau* (番也,亦作茂), 9653a, May 17, 1922; open hillside, mt. side thicket; shrub; ht., 3-4 m.; dia., 5-8 cm.; fls., brownish yellow; name reported, *Chung ping shu* (中平樹).

147.4424—RICINUS COMMUNIS Linn.

Five Finger Mt., (五指嶺), 8575, Dec. 21, 1921 and *Ting On River* (定安河), 8915, Apr. 8, 1922; edge of stream near village, on bank near water; alt., 60-600 m.; shrub; ht., 1-2 m.; fls., red, yellow; drug plant; seeds yield an oil used as illuminant; names reported, *Hung pi ma* (紅萆蔴), *Pi ma shu* (萆蔴樹), *Pi ma tsz* (萆蔴子).

147.4425—HOMONOIA RIPARIA Lour.

Fan Lun (番掄), 9172, Apr. 19, 1922, *Hainan* and *Shui Mun* (海南,水門), 9619, 9620, 9621, May 15, 1922; near stream, in partially wooded ravine; shrub; ht., 1-3 m.; fls., pistilate flower only, reddish, yellow; name reported, *Shui yeung mui* (水楊梅).

147.4428—ALEURITES MOLUCCANA (Linn.) Willd.

Hong Ma Ts'un (康馬村), 8305, Dec. [illegible], 1921 and *Fan Lun* (番掄) 9175, Apr. 19, 1922; village commons; alt., 300 m.; tree; ht., 7-10 m.; dia., 4-20 cm.; fls., white; oil from seeds used as illuminant; names reported, *Shek lut* (石栗), *Yau t'o* (油桃), *T'ung yau kung* (桐油公).

147.4428—ALEURITES MONTANA (Lour.) Wils.

Hainan, Yik Tsok Mau (海南,亦作茂), 9737, May 19, 1922; on open hillside; tree; ht., 15 m.; dia., 30 cm.; name reported, *T'ung yau* (桐油).

147.4433—JATROPHA CURCAS Linn.

Hoihow (海口), 7651, Oct. 11, 1921 and *Ting On River* (定安河) 8875, Apr. 6, 1922; on city wall; alt., 40 m.; tree; ht., 3-5 m.; dia., 12 cm.; fls., yellow, green; oil pressed from seeds used as illuminant; names reported, *Ka pak lan* (假白欖), *Ma fung shu* (痳瘋樹), *Wong chung shu* (黃腫樹).

147.4436—HEVEA BRASILIENSIS (HBK.) Muell.—Arg.

Hainan, N. W. of Nodoa (海南,那大之西北), 9813, Apr. 15, 1922; cultivated on hillside; tree; fls., cream, very fragrant; the sap of the tree is collected in cups, treated, smoked, and sold as commercial rubber name reported, *Kau shu* (膠樹).

147.4444—MANIHOT UTILISSIMA Pohl.

Ooi Diok, Kachek (? ,嘉積), 8791, Oct. 15, 1921 and *Hainan, Fan Ya* (海南,番也), 9290, Apr. 26, 1922; in cultivated field; ht., 1-1½ m.; fls., pale yellow with a faint purple on edge; tubers or roots used as food in form of Tapioca; name reported, *Kot shu* (葛薯).

147.4456—OSTODES PANICULATUS Blume

Five Finger Mt., (五指嶺), 8645, Dec. 16, 1921 and 9355, 9363, Apr. 29, 1922; wooded mt. side, wooded ravine; alt., 1300 m.; tree; ht., 5-12 m.; dia., 3-25 cm.; fls., white.

147.4459—BLACHIA PENTZII (Muell.—Arg.) Benth.

Tai Tsing (大井), 7699, 7884, Oct. 25, 1921; roadside; bush; ht., 1 m.; fls., white.

147.4464—GELONIUM GLOMERULATUM (Blume) Hassk.

Hainan, Yik Tsok Mau (海南,亦作茂), 9739, May 19, 1922; on hillside among shrubs; shrub; ht., 3½ m.; dia., 10 cm.; frs., yellow.

147.4470—ENDOSPERMUM CHINENSE Benth.

Hainan, Kachek, Wong Chuk (海南,嘉積 ?), 9788, June 1, 1922; at roadside in open country; tree; ht., 12 m.; dia., 60 cm.; frs., yellow when ripe; small branches used as an ingredient in some incense; name reported, *Wong ch'ung shu* (黄蟲樹).

147.4476—SEBASTIANA CHAMAELEA (Linn.) Muell.—Arg.
var. ASPEROCOCCA Pax. & Hoffm.

Nodoa (那大), 7692, Oct. 30, 1921, *Hoihow* (海口), 7569, Oct. 12, 1921 and *Ting On River* (定安河), 8859, Apr. 6, 1922; sandy waste, in dry cultivated sandy field, dry roadside; herb; alt., 40 m.; frs., yellow, red; prostrate.

147.4483—SAPIUM DISCOLOR (Champ.) Muell.—Arg.

Hainan, Kachek, Wong Chuk (海南,嘉積, ?), 9795, June 1, 1922; open country, at roadside; tree; ht., 5 m.

147.4483—SAPIUM SEBIFERUM Roxb.

Hoihow (海口), 7606, Oct. 12, 1921 and *Hainan, Sun Ngai, Tung Ngai* (海南,船崖,東崖), 8886, Apr. 7, 1922; at foot of city wall; alt., 50 m.; tree; ht., 3-10 m., fls., brown; drug and economic plant; roots yield a purgative; seeds yield an oil which is used as an illuminant; name reported, *U kau shu* (烏桕樹).

An economic specimen of this was secured on the Canton market by E. H. Groff under the name of *U kau shu* (烏桕樹), C. C. C. Ec. No. 146. It is very commonly found on Honan Island opposite Canton. The price is about 20 cent. per catty L. S. for the roots. The roots are used as a purgative and the seeds yield an oil used as an illuminant.

147.4498—EUPHORBIA CAPILLARIS Gagnep.

Hoihow (海口), 7589, Oct. 10, 1921; dry sandy places; herb; prostrate; fls., yellow.

147.4498—EUPHORBIA SERRULATA Reinw.

Hainan, Nga Wan, Yik Tsok Mau (海南,牙環,亦作茂), 9261, Apr. 23, 1922; open grassy hillside; ht., 7-10 m,; fls., white.

147.4498—EUPHORBIA THYMIFOLIA Linn.

Ting On River (定安河), 8899, Apr. 7, 1922; sandy waste; fls., reddish.

149—Buxaceae

149.4531—SARCOCOCCA EUPHLEBIA Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8586, Dec. 21, 1921 and 9589, May 14, 1922; wooded ravine; shrub; ht., 1½ m.

153—Anacardiaceae

153.4552—SPONDIAS AXILLARIS Roxb.

Hainan, Yik Tsok Mau (海南,亦作茂), 9753, May 19, 1922; in forested ravines; name reported, ***Sun t'so shu*** (酸醋樹).

153.4552—SPONDIAS PINNATA (Linn.) Kurz

Nodoa, Sha Po Ling (那大,沙煲嶺), 8188, Nov. 11, 1921; thicket in ravine; alt., 450 m.; tree; ht., 10 m.; dia., 15 cm.; frs., edible; name reported, *Pan long ts'ing* (梹榔青).

153.4594—RHUS HYPOLEUCA Champ.

Near Tai Tsing (近大井), 8230, Oct. 25, 1921; dry deserted field; bush; ht., 2 m.; fls., maroon, red.

153.4594—RHUS SUCCEDANA Linn.

Near Mi Ting (美亭), 7744, Oct. 26, 1921 and *Hainan, W. of Notia* (海南,和舍之西), 8962, Apr. 11, 1922; edge of thicket, along stream; tree; ht., 3 m.; name reported, *Ts'at shu* (漆樹).

153.4560—POUPARTIA CHINENSIS Merr.

Hainan, N. of Fan Ta (海南,番打之北), 9135, Apr. 18, 1922; on bank of little stream; tree; ht., 10 m.; fls., cream; name reported, *Ka muk wan* (假木槵).

155—Pentaphylacaceae

155.4612—PENTAPHYLAX EURYOIDES Gardn. & Champ.

Five Finger Mt., (五指嶺), 8699, Dec 14, 1921; the summit of the thumb; alt., 1600 m. If properly placed, then certainly an undesirable species. E.D.M.

155.? ? ?—

Five Finger Mt., (五指嶺), 9387, May 1, 1922; growing in rich, loose, mossy soil; shrub; ht. 1 m.; fls., whitish.

157—Aquifoliaceae

157.4614—ILEX CINEREA Champ. var.

Five Finger Mt., (五指嶺), 9424, May 4, 1922, 9458, May 6, 1922, 9534, May 11, 1922; wooded ravine; tree; ht., 5-12 m.; dia., 15 cm.

157.4614—ILEX ROTUNDA Thunb.

Nodoa (那大), 7705, Oct. 30, 1921; roadside; alt., 250 m.; tree; ht., 10 m.; frs., red.

157.4614—ILEX TRIFLORA Blume var. VIRIDIS (Champ.) Loesen.

Five Finger Mt., (五指嶺), 9394, May 1, 1922; growing under shrubs in rich loose soil; bush; ht., 1 m.; fls., white.

158—Celastraceae

158.4618—EUONYMUS LAXIFLORUS Champ.

Five Finger Mt., (五指嶺), 8500, Dec. 23, 1921, 8683, Dec. 21, 1921, 9444b, 9447, May 5, 1922, 9485, May 7, 1922 and 9531, May 11, 1922; wooded ravine, mt. side forest, in heavy forest; alt., 750-800 m.; tree; ht., 2-5 m.; dia., 2-8 cm.; fls., maroon, white, green; frs., pods red, seeds black.

158.4618—EUONYMUS SP. aff. COCHINCHINENSIS Pierre.

Five Finger Mt., (五指嶺), 8579, Dec. 21, 1921; mt. side forest; alt., 800 m.; shrub; ht., 2 m.; seeds dark red, pods yellowish red.

158.4625—GYMNOSPORIA DIVERSIFOLIA Maxim.
(CELASTRUS DIVERSIFOLIUS Hemsl.)

Hoihow (海口), 7573, Oct. 10, 1922 and 7591, Oct. 11, 1921; foot of city wall; bush; ht., 2/3 m.; fls., yellow, white.

158.4625—CELASTRUS HINDSII Benth.

Nodoa (那大), 7938, Oct. 28, 1921; near stream on shrubs; alt., 250 m.; vine.

158.4625—CELASTRUS PANICULATA Willd.

Hainan, Ka La (海南,加拉), 9182, Apr. 20, 1922; vine; ht., 2-3 m.; fls., yellowish, fragrant.

161—Staphyleaceae

161.4666—TURPINIA POMIFERA (Roxb.) DC. var.

Five Finger Mt., (五指嶺), 8497, 8510**, Dec. 23, 1921; wooded ravine; alt., 750 m.; shrub; ht., 3 m.

162—Icacinaceae

162.4684—GOMPHANDRA HAINANENSIS Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8546, Dec. 20, 1921, 9467, May 6, 1922 and 9570, May 13, 1922; wooded mt. side, wooded ravine; alt., 700 m.; shrub; ht., 1½-2 m.; fls., light yellow.

162.4697—GONOCARYUM MACLUREI Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8606, Dec. 16, 1921 and *Hainan, Nga Wan* (海南,牙環), 9252, Apr. 22, 1922; partially wooded hillside; alt, 700 m.; tree; ht., 4 m.; dia., 10 cm.; frs. black.

162.4704—IODES OVALIS Blume var.

Hainan, Nga Wan, Yik Tsok Mau (海南,牙環,亦作茂), 9268, Apr. 23, 1922; on shrubs; vine.

162.4718—CARDIOPTERIS MOLUCCANA Blume
(C. LOBATA Wall.)

Five Finger Mt., (五指嶺), 8530, Dec. 30, 1921 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9694, May 18, 1922; edge of wooded ravine on tree; alt., 600 m.; vine; ht., 8-10 m.; fls., yellow.

163—Aceraceae

163.4720—ACER FABRI Hance

Hainan, Yik Tsok Mau (海南,亦作茂), 9728, May 19, 1922; wooded ravine; tree; ht., 8 m.; dia., 10 cm.; frs., wings of fruits red and green.

165—Sapindaceae

165.4726—CARDIOSPERMUM HALICACABUM Linn.

Hoihow (海口), 7633, Oct. 10, 1921 and *Hainan, Kingchow* (海南.瓊州), 8814, Apr. 5, 1922; bamboo thicket, on city wall; alt., 10 m.; vine; ht., 7 m.; fls., white; drug plant; water in which the leaves have been steeped used to wash itching skin; name reported, *Tang lung p'ok* (燈籠朴).

Economic specimen of this secured on the Canton market by E. H. Groff under the name of *Tang lung p'ok* (燈籠朴), C. C. C. Ec. No. 147. It is reported as coming from Kwangtung and Kwangsi as well as Hainan. The roots are said to be boiled and the water taken internally as medicine.

165.4734—ALLOPHYLUS RACEMOSUS (Linn.) Radlk.

Hoihow (海口), 7588, 7670**, Oct. 11, 1921 and *Nodoa, Pat Ka Ling* (那大.筆架嶺), 7905, Nov. 1, 1921, *Nodoa, Lin Fa Ling* (那大,蓮花嶺), 8098, Nov. 4, 1921; among shrubs at roadside, hillside thicket; alt., 400 m.; bush; ht., 1-1½ m.; frs., red, yellow.

165.4739—SAPINDUS MUKOROSSI Gaertn.

Nodoa, San Ts'un (那大,新村), 8005, Nov. 15, 1921 and *Hainan, Kingchow* (海南.瓊州), 8802, Apr. 5, 1922; village commons; alt., 250 m.; tree; ht., 7-12 m.; dia., 35-60 cm.: fls., yellowish white; frs., golden brown; fruits used as soap by natives; names reported, *Muk wan shu* (木槵樹), *Muk man* (木蔄).

165.4742—ERIOGLOSSUM RUBIGINOSUM (Roxb.) Blume
(E. EDULE Blume)

Hainan, T'a Hon, Nga Wan (海南,他寒.牙環), 9256, Apr. 22, 1922; half open hillside; shrub; ht., 2 m.; fls., red.

165.4776—LITCHI CHINENSIS Sonn.

Nodoa, Hainan (那大,海南), 8989, Apr. 12, 1922; in high, well drained clay soil; tree; ht., 7 m.; dia., 20 cm.; frs., edible, but quite sour, probably "mountain" lychee; name reported, *Lai chi* (荔枝).

McClure secured economic specimen of the wood of this tree, C. C. C. Ec. No. 148 (McClure Ec. No. 60). He says, "The lychee tree not only produces edible fruit but furnishes a splendid hard wood which is used in the construction of boats as well as frames for doors, etc. It is used by the Missionaries at Nodoa for outside construction where it is exposed to the weather, for it resists weathering very well. The wood is very heavy and hard to work. Experienced carpenters can readily distinguish between the wood of the tame and the wild lychee and for the latter a much lower price is paid, because it is inferior in quality. The lychees of the district around *On Yan* (安仁), about 14 miles west of Hoihow, are famous for their size and flavor.

165.4778—XEROSPERMUM TOPINGII Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 9455, May 5, 1922; slope in wooded mountain side, in rich, loose soil; tree; 10 m.; dia., 15 cm.; frs., immature; wood very tough but not so good as the cultivated varieties of lychee; it is sometimes substituted for the latter when an experienced person is buying lumber; name reported, *Shan lai chi* (山荔枝).

165.4819—ARYTERA LITTORALIS Blume

Nodoa, Pat Ka Ling (那大,筆架嶺), 7703, Oct. 30, 1921, *Five Finger Mt.*, (五指嶺), 8610, Dec. 26, 1921 and *Hainan, W. of Tai Un, San Hu* (海南,西部之大園,新墟), 8957, Apr. 10, 1922; in thicket, wooded mt. side, in waste land near stream; alt., 280-700 m.; tree; ht., 2-5 m.; dia., 8 cm.; fls., yellow with red seed; frs., yellow.

165.4820—PEDICELLIA OPPOSITIFOLIA Lour.
(MISCHOCARPUS SUNDAICUS Blume.)

Five Finger Mt., (五指嶺), 9364, Apr. 29, 1922 and *Hainan, Fan Ya to Yik Tsok Mau* (海南,番也.亦作茂), 9663, May 17, 1922; wooded ravine; tree; ht., 10-15 m.; dia., 25 cm., fls., yellow, very conspicuous; frs., yellow, seeds red.

165.4831—DODONAEA VISCOSA (Linn.) Jacq.

Nodoa (那大), 7933, Oct. 31, 1921 and *Hainan, W. of Notia* (海南,和舍西部), 8961, Apr. 11, 1922; moist shady ravine, in shrubby waste land; bush; ht., 1½ m.; fls., greenish yellow.

165.4841—HARPULLIA CUPANIOIDES Roxb.

Hainan, near Shui Mun (海南.水門), 9618, May 15, 1922 and 9635, May 15, 1922; in thicket on bank of stream; tree; ht., 7-8 m.; dia., 12-15 cm.; fls., white fragrant.

166—Sabiaceae

166.4850—SABIA LIMONACEA Wall.

Five Finger Mt., (五指嶺), 8704, Dec. 20, 1921; moist shady ravine; alt., 600 m.; vine; ht., 10 m.; dia., 2 cm.; fls., yellowish.

166.4851—MELIOSMA ANGUSTIFOLIOLA Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 8507, Dec. 22, 1921 and 9503, May 9, 1922; wooded ravine; alt., 950 m.; tree; ht., 5-10 m.; dia., 15-20 cm.; fls., greenish yellow; frs., berries, red.

166.4851—MELIOSMA BUCHANANIFOLIA Merr. SP. NOV.
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Hainan, Yik Tsok Mau (海南,亦作茂), 9732, May 19, 1922; wooded ravine; tree; ht., 12 m.; dia., 25 cm.; fls., yellowish white; the bark of this tree is used by Chinese in villages in making incense; name reported, *Fa muk heung* (花木香).

166.4851—MELIOSMA TSANGTAKII Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 9438, May 4, 1922 and 9498, May 9, 1922; in densely wooded ravine; tree; ht., 10 to 12 m.; dia., 20-30 cm.; fls., yellowish, brownish white.

169—Rhamnaceae

169.4868—BERCHEMIA FLORIBUNDA Wall.

Five Finger Mt., (五指嶺), 9568, May 13, 1922; on shrubs on mt. side; vine; ht., 5 m.

169.4868—BERCHEMIA YUNNANENSIS Franch.

Hainan, Kingchow (海南,瓊州), 7551, Oct. 14, 1921, *Nodoa, Pat Ka Ling* (那大,筆架嶺), 8020, Oct. 28, 1921 and *Ting On River* (定安河), 8873, Apr. 6, 1922; bamboo thicket, on shrubs by roadside; alt., 250 m.; vine; ht., 3 m.; fls., white.

169.4871—RHAMNELLA HAINANENSIS Merr. SP. NOV.
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Five Finger Mt., Hop Lo Ts'un (五指嶺·合籮村), 8358, Dec. 6, 1921; in shady ravine; alt., 800 m.; shrub; ht., 3 m.; frs., deep red when ripe.

169.4875—RHAMNUS NIPALENSIS Wall.

Kingchow (瓊州), 7629, Oct. 14, 1921; dry thicket; bush; ht., 2 m.; frs., red.

169.4902—GOUANIA JAVANICA Miq.

Ka La, Fan Ya (加拉,番也), 8323, Dec. 29, 1921; roadside; alt., 350 m.; vine.

170—Vitaceae

170.4913—TETRASTIGMA HARMANDII Planch.

Hoihow (海口), 7625, Oct. 11, 1921, *Nodoa* (那大), 7691, Oct. 30, 1921 and *Ka La* (加拉), 9188, Apr. 20, 1922; on city wall, growing on shrubs on tree in dry soil; alt., 250 m.; vine; ht., 10-12 m.; names reported, *Kwo shan lung* (過山龍), *Ma tai t'ang* (孖帶藤).

170.4913—TETRASTIGMA SP. aff. HEMSLEYANUM Diels & Gilg.

Hong Ma Ts'un (康馬村), 8311, Dec. 3, 1921 and *Nga Wan* (牙環), 8346, Dec. 6, 1921; thicket near village; alt., 400 m.; vine.

170.4913—TETRASTIGMA PLANICAULE Gagnep.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 8075, Nov. 3, 1921; in tree tops in forest; alt., 350 m.; vine; ht., 12 m.; dia., 2 cm.

170.4913—TETRASTIGMA SP.

Five Finger Mt., (五指嶺), 8375, Dec. 10, 1921 and 8582, Dec. 21, 1921; roadside on bushes, edge of mt. stream, wooded ravine; alt., 600-1000 m.; vine; ht., 10-30 m.; dia., 2-4 cm.; frs., black, yellow when ripe.

170.4916—AMPELOPSIS BREVIPEDUNCULATA (Maxim.) Koehne.

Kingchow (瓊州), 7529, Oct. 14, 1921 and *Hainan, nearShui Mun* (海南,近水門), 9612, May 15, 1922; in partially wooded ravine; vine; ht., 3-4 m.; fls., yellow and green.

170.4916—AMPELOPSIS CANTONIENSIS (Hook. & Arn.) Planch.

Hainan, Fan Ya (海南,番也), 8148**, 9295, Apr. 26, 1922, and 9525, May 10, 1922; on shrubs at edge of thicket; vine; ht., 3-5 m.; fls., yellowish; drug plant; leaves toasted hot used in treating pains such as rheumatism; the vine is used by the Lois to lead their water buffalo.

170.4918—CISSUS GLABERRIMA (Wall.) Planch.

Hoihow (海口), 7543, Oct. 9, 1921, *Nodoa* (那大), 7717, Oct. 28, 1921 and *Fan Ya* (番也), 9626, May 15, 1922; bamboo thicket, near stream on shrubs on hillside; alt., 250 m.; vine; ht., 1½-2 m.; fls., yellow, white, red.

170.4918—CISSUS REPENS Lam.

Tai Tsing (大井), 7893, Oct. 24, 1921, *Ka La* (加拉), 8320, Dec. 4, 1921 and 8321 Dec. 4, 1921; roadside on shrubs; on trees in ravine; alt., 350 m.; vine.

170.4918—CISSUS SP.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7904, Nov. 1, 1921; on shrubs, edge of thicket; alt., 250 m.; vine; fls , light yellow.

170.4918—COLUMELLA CORNICULATA (Benth.) Merr.

Five Finger Mt., (五指嶺), 9446, May 5, 1922; on tree in wooded ravine; vine; ht., 4-5 m.; fls., green.

170.4918—COLUMELLA JAPONICA (Thunb.) Merr.

Hainan, S. of Fan Ta (海南,南部之番打), 9162, Apr. 19, 1922 and *Hainan, near Shui Mun* (海南,近水門), 9613, May 15, 1922; on shrub at edge of stream, in partially wooded ravine; vine; ht., 3-5 m.; fls., white, yellow; name reported, *Ng ts'au lung* (五爪龍).

170.4918—COLUMELLA WRAYI (King) Merr.

Nam Fung (南風), 8276, Nov. 30, 1921, *Hong Ma Ts'un* (康馬村), 8308, Dec. 3, 1921, *Ka La* (加拉), 9194, Apr. 20, 1922 and 9266, Apr. 23, 1922, *Five Finger Mt.*, (五指嶺), 9413, May 4, 1922, *Hainan, Fan Ya* (海南,番也), 9544, May 13, 1922; shady ravine on shrubs, in thicket, on shrubs on stream bank, in heavily wooded ravine; alt., 350-400 m.; vine; ht., 5-10 m.; fls., red, yellow; frs., red.

170.4918—COLUMELLA SP.

Five Finger Mt., (五指嶺), 9418, May 4, 1922; wooded ravine; vine; ht., 30 m.; dia., 10 cm.; frs., red.

170.4919—LEEA INDICA (Burm. f.) Merr.
(L. SAMBUCINA Willd.)

Nodoa, Pat Ka Ling (那大,筆架嶺), 8037, Nov. 1, 1921, *Nodoa, Sha Po Ling* (那大,沙煲嶺), 8195, Nov. 11, 1921, *Nam Fung* (南風), 8262, Dec. 2, 1921, 8265, Dec. 2, 1921 and *Ka La* (加拉), 9185, Apr. 20, 1922; on trees in thicket, moist shady ravine, hillside, roadside; dry land; alt., 250-400 m.; vine; ht., 1½-7 m.; fls., white, greenish.

171—Elaeocarpaceae

171.4921—ELAEOCARPUS APICULATUS Mast.

Hainan, Yik Tsok Mau (海南,亦作茂), 9681, May, 18, 1922; wooded ravine; tree; ht., 15, m.; dia., 45 cm.

171.4921—ELAEOCARPUS CHINENSIS (Gardn. & Champ.) Hook f.

Hainan, Yik Tsok Mau (海南,亦作茂), 9656, May 17, 1922 and 9685, May 18, 1922; in partially wooded ravine; tree; ht., 8-10 m.; dia., 12-25 cm.

171.4921—ELAEOCARPUS GLABRIPETALUS Merr. SP. NOV.
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Five Finger Mt., (五指嶺), 9459, May 6, 1922; in forest; tree; ht., 6 m.; dia., 5 cm.; fls., white, slightly fragrant. Mr. Merrill's description of this new species is based upon plants secured by Mr. McClure in northern Kwangtung, Taai Yeung Shan, July 20, 1921, and recorded under C. C. C. Nos. 6505, 6467, and 7213.

171.4921—ELAEOCARPUS HAINANENSIS Oliv.
var. BRACHYPHYLLUS Merr.

Hainan, N. Fan Ta (海南,北部之番打), 9132, Apr. 19, 1922, *Hainan, Fan Lun* (海南,番掄), 9176, Apr. 19, 1922 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9757, May, 1922; bank of stream; shrub; ht., 2/3-9 m.; fls., greenish, brownish, red; fruits edible; name reported, *Shui shek yung* (水石榕).

171.4921—ELAEOCARPUS JAPONICUS S. & *Z.* var.
EUPHLEBIUS Merr.

Five Finger Mt., (五指嶺), 9379, May 1, 1922; in loose mossy soil; tree; ht., 3 m.; dia., 8 cm.

171.4921—ELAEOCARPUS SUBGLOBOSUS Merr.

Five Finger Mt., (五指嶺), 8597, Dec. 16, 1921; wooded ravine; alt., 1300 m.; tree; ht., 30 m.; dia., 65 cm.

171.4921—ELAEOCARPUS SP.

Five Finger Mt., (五指嶺), 9549, May 13, 1922; s. slope in forest; tree; ht., 10 m.; dia., 30 cm.; frs., immature.

174—Tiliaceae

174.4953—CORCHORUS ACUTANGULUS Lam.

Kingchow (瓊州), 7537, Oct. 14, 1921; dry, grassy places; herb; fls., yellow; name reported, *Ka tsiu ts'o* (假蕉草).

174.4966—GREWIA ABUTILIFOLIA Vent.

Hainan, near Tau Ti P'o (海南, ?), 9125, Apr. 18, 1922; in waste places along roadside; tree; ht., 3-4 m.; fls., yellowish; used to make rough cloth and string; C. C. C. Ec. No. 149 (McClure Ec. No. 23); names reported, *Kau muk* (膠木), *Shan ma shu* (散麻樹), *Pak yau kau* (白油膠).

174.4966—GREWIA CHUNGII Merr. SP. NOV.
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Hainan, South of Ka La (海南,加拉之南), 9197, Apr. 21, 1922 and *Five Finger Mt.*, (五指嶺), 9314, Apr. 28, 1922; on tree along stream, wooded ravine; tree; ht., 6-20 m.; dia., 60 cm.; fls., red, orange, yellow, slightly fragrant.

174.4966—GREWIA ERIOCARPA Juss.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7851, Nov. 1, 1921; roadside; shrub; ht., 2 m.

174.4966—GREWIA MICROCOS Linn.

On Yan (安仁), 7881, Oct. 25, 1921; roadside; shrub; ht., 1½ m.; fls., yellowish white.

174.4975—TRIUMFETTA BARTRAMIA Linn.
(T. RHOMBOIDEA Jacq.)

Hoihow (海口), 7600, Oct. 11, 1921 and *Nodoa* (那大), 7940, Oct. 31, 1921; foot of city wall, moist shady places; bush; ht., 1 m.; fls., yellow.

174.4975—TRIUMFETTA TOMENTOSA Boj.
(T. PILOSA Roth.)

Nodoa, Pat Ka Ling (那大,筆架嶺), 7847, Nov. 1, 1921; edge of thicket; herb; fls., yellow.

175—Malvaceae

175.4983—ABUTILON INDICUM (Linn.) Sweet

Hoihow (海口), 7630, Oct. 10, 1921 and *Hainan, Kingchow* (海南,瓊州), 8804, Apr. 5, 1922; dry land, edge of pond, in grassy roadside; alt., 10 m.; herb; ht., 2/3-1 m.; fls., yellow; drug plant; name reported, *Mo tsz shu* (磨子樹).

175.4998—SIDA ACUTA Burm f.

Hainan, Kingchow (海南,瓊州), 7558, Oct. 14, 1921, *Fan Lun* (番掄), 9173, Apr. 19, 1922; grassy field; herb; ht., 1/3-1 m.; fls., yellow; used by natives to make rough brooms on account of its toughtness; name reported, *Wong fa nim* (黃花稔).

175.4998—SIDA CORDIFOLIA Linn.

Hoihow (海口), 7568, Oct., 11, 1921; dry field; herb; fls., yellow.

175.4998—SIDA CORYLIFOLIA Wall.

Tai Tsing (大井), 7667, Oct. 24, 1921; dry roadside; herb; ht., 2/3 m.; fls., bright orange yellow.

175.4998—SIDA FALLAX Walp.

Hainan, Kingchow (海南,瓊州), 8836, Apr. 5, 1922; grassy place; alt., 10 m.; ht., 40 m.; fls., yellow; name reported, *Wong fa nim* (黃花稔).

175.5006—URENA LOBATA Linn.

Hoihow (海口), 7566, Oct. 12, 1921, and 7585, Oct. 10, 1921; dry rice field, edge of thicket; herb; fls, pink to red.

175.5013—HIBISCUS SURATTENSIS Linn.

Hoihow (海口), 7619, Oct. 10, 1921 and *Ting On River* (定安河), 8855, Apr. 6, 1922; dry grassy places; in hedge; alt., 20 m.; vine; ht., 2-3 m.; fls., yellow with maroon center.

175.5013—HIBISCUS TILIACEUS Linn.

Hoihow (海口), 7888, Oct. 24, 1921; dry roadside; tree; ht., 5 m.; fls. yellow with maroon center; name reported, *Mong fa* (棡花).

175.5014—ABELMOSCHUS CANCELLATUS (Roxb.) Wall.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7728, Nov. 1, 1921; edge of thicket; herb; ht, 1 m.

175.5014—ABELMOSCHUS MOSCHATUS Medic.

On Yan (安仁), 7662, Oct. 25, 1921, 7831**, *Nodoa, Lin Fa Ling* (那大,蓮花嶺), 8048, Nov. 2, 1921, *Hainan, near Tau Ti P'o* (海南, ?), 9130, Apr. 18, 1922; dry roadside, in hedge, in tall grass between rice field; alt., 250 m.; bush; ht., 1-2½ m; fls., light yellow with maroon center; drug plant; pounded roots used as a poultice for boils; name reported, *Ka sam nim* (假三稔).

175.5014—ABELMOSCHUS SAGGITIFOLIUS (Kurz.) Merr.

Hainan, near Nam Fung (海南,近南風), 9824, Apr. 17, 1922; roadside in waste places; vine; ht., 1/3-2½ m.; fls., bright pink; drug plant; name reported, *Hung fa shu* (紅花樹).

175.5018—THESPESIA POPULNEA (Linn.) Corr.

Hoihow (海口), 7655, Oct. 11, 1921; village commons; alt., 4-5 m.; tree; ht., 4 m.; fls., bud brownish.

175.5020—GOSSYPIUM BRASILIENSE Macf.

Nodoa (那大), 7991, Nov. 20, 1921 and *Hong Ma Ts'un* (康馬村), 8306, Nov. 20, 1921; garden of village, village commons; alt., 250 m.; bush; ht., 1½-2 m.; dia., 3 cm., fls., light yellow; name reported, *Yeung min fa* (洋棉花).

177—Bombacaceae

177.5024—BOMBAX CEIBA Linn.

Hainan, Nga Wan, Yik Tsok Mau (海南,牙環,亦作茂), 9270, Apr. 23, 1922; tree; ht., 8-10 m.; dia., 25 cm.; fls., bright red; fruits, yield a cotton in which the seeds are large and are carried by the wind; used in Canton in making pillows and sometimes by the Lois in making cloth; C. C. C. Ec. No. 150 (McClure Ec. No. 96); name reported, *Muk min* (木棉).

178—Sterculiaceae

178.5059—WALTHERIA AMERICANA Linn.

Hainan, Kingchow (海南,瓊州), 8835, Apr. 5, 1922; grassy place at roadside; alt., 10 m.; ht., 30 cm.; fls., yellow.

178.5062—BUETTNERIA ASPERA Colebr.

Nodoa, Lin Fa Ling (那大.蓮花嶺), 8103, Nov. 4, 1921, *South of Ka La* (加拉之南部), 9195, Apr. 21, 1922 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9721, May 19, 1922; in trees in thicket, growing on banyan tree along stream; in wooded ravine; alt., 450 m.; vine; ht., 7-15 m.; dia., 3 cm.; fls., greenish with red center.

178.5067—ABROMA AUGUSTA Linn. f.

Five Finger Mt., Yik Tsok Mau (五指嶺,亦作茂), 8469, Dec. 20, 1921, *Hainan, Yik Tsok Mau* (海南,亦作茂), 9273, Apr. 24, 1922; village commons; alt., 600 m.; shrub; ht., 3 m.; fls., maroon; the inner bark of this plant is used by the Lois to weave coarse textiles, C. C. C. Ec. No. 152 (McClure Ec. No. 19); seeds secured, C. C. C. Ec. No. 151 (McClure Ec. No. 113); name reported, *Shui ma* (水蔴).

178.5078—REEVESIA THYRSOIDEA Lindl.

Five Finger Mt., Fan Ya (五指嶺,番也), 8445, Dec. 7, 1921; in forest on hillside; alt., 1000 m.; tree; ht., 7 m.; dia., 20 cm.

178.5080—PTEROSPERMUN LEVINEI Merr.

Near Notia (近和舍), 7675, Oct. 27, 1921, *near Tai Un* (近大園), 7733, Oct. 26, 1921, *Nam Fung* (南風), 8286, Nov. 30, 1921 and *Yik Tsok Mau* (亦作茂), 9754, May 19, 1922; dry shrubby rolling couutry, dry roadside, edge of ravine, wooded ravine; alt., 275 m.; tree; ht., 3-8 m.; dia., 3-20 cm.; fls., white, slightly fragrant; frs., brown; wood of this tree is very tough and hard, and is used by the Lois in building; the "kaak" or heart wood is red; names reported, *Sai ip p'au shu* (細葉砲樹), *Ka pok* (加博); specimen of wood, C. C. C. Ec. No. 153 (McClure Ec. No. 92a).

178.5081—HELICTERES ANGUSTIFOLIA Linn.

Near Tai Un (近大園), 7829, Oct. 26, 1921, *Nodoa, Pat Ka Ling* (那大,筆架嶺), 8034, Nov. 1, 1921 and *Hainan, near Nodoa* (海南,那大), 8985, Apr. 11, 1922; roadside among grasses, edge of clearing; alt., 250 m.; bush; ht., 2 m.; fls., pink; drug plant; names reported, *Po ma* (坡蔴), *Ka yau ma* (假油蔴).

178.5081—HELICTERES HIRSUTA Lour.

Near Tai Tsing (近大井), 7681, Oct. 24, 1921, *Hainan, West of Notia* (海南,和舍之西部), 8965, Apr. 11, 1922; roadside among shrubs, in shrubby waste land; bush; ht., 1-2 m.; fls., purple, crimson; name reported, *Siu p'o ma*(蕭婆蔴).

178.5081—HELICTERES ISORA Linn.

T'a Hon to Nga Wan (他寒至牙環), 8352, Dec. 6, 1921, and 9243, Apr. 22, 1922; hillside among shrubs; alt., 650 m.; shrub; ht., 2-2½ m.; fls., red; inner bark of this tree used to make cloth, C. C. C. Ec. No. 154 (McClure Ec. No. 21); name reported, *Fo sok ma* (火索蔴).

178.5082—KLEINHOFIA HOSPITA Linn.

Kam Kong (金江), 8244, Oct. 26, 1921, *Nam Fung* (南風), 8263, Dec. 2, 1921; river bank, hillside; alt., 275 m.; tree; ht., 7 m.; dia., 20 cm.; fls., pink.

178.5083—STERCULIA LANCEOLATA Cav.

Hainan, near Ting On River (海南.近定安河), 8933, Apr. 9, 1922; alt., 70 m.; ht., 4 m.; dia., 8 cm.; fls., red; seeds, edible; promising ornamental; name reported, *Ka p'an p'o* (假蘋婆).

180—Dilleniaceae

180.5098—TETRACERA SCANDENS (Linn.) Merr.
(T. SARMENTOSA Vahl.)

Near Tai Un (近大園), 7743, Oct. 26, 1921, *Hainan, near Fan Ta* (海南.近番打), 9526, May 10, 1922 and *Kachek, Wong Chuk* (嘉積, ?), 9782, June 1, 1922; roadside on shrubs, edge of thicket; vine; ht., 2-5 m.; fls., white, fragrant; the vine is used by the Lois to lead water buffalo; name reported, *Sut t'ang* (雪藤).

180.5106—DILLENIA TURBINATA Finet & Gagnep.

Hainan, Yik Tsok Mau, Fan Ya (海南,亦作茂,番也), 9275, Apr. 25, 1922; open grassy hillside; tree; ht., 5-8 m.; fls., bright yellow; frs., edible; name reported, *P'i p'a shu* (枇杷樹).

180.5107—ACTINIDIA LATIFOLIA (Gardn. & Champ.) Merr.
(A. CHAMPIONI Benth.)

Lin Fa Ling (蓮花嶺), 8061, Nov. 3, 1921, *Five Finger Mt.*, (五指嶺), 9487, May 8, 1922; edge of thicket, on tree in partially open region; alt., 350 m.; vine; ht., 7-12 m.; fls., yellow; frs., rusty brown.

180.5109—SAURAUIA TRISTYLA DC.

Nam Fung (南風), 8277, Nov. 30, 1921, *Hainan, near Tau Ti P'o* (海南, ?), 9129, Apr. 18, 1922; ravine, on bank of small stream; alt., 250 m; tree; ht., 5-8 m.; dia., 12 cm.; fls., faint pinkish white, fragrant; frs., edible.

182—Ochnaceae

182.5112—OCHNA HARMANDII (Van Teigh.) H. Lecomte

Hainan, N. of Fan Ta (海南.番打之北部), 9138, Apr. 18, 1922; in thicket near small stream; tree; ht., 6 m.; dia., 8 cm.; fls., red.

186—Theaceae

186.5147—THEA OLEOSA Lour.
(T. DRUPIFERA)

Near Tai Un (近大園), 7673, Oct. 26, 1921, *Kam Kong, Fa Hi* (金江, ?), 8236, Jan. 4, 1922, *Kachek* (嘉積), 8799, Oct. 14, 1921, *Hainan, near Oo P'o* (海南, ?), 9775, May, 1922; planted by a farmer in a grave, sandy soil near river, cultivated, roadside; shrub; ht., 3-4 m.; dia., 6-18 cm.; fls., white, fragrant; oil pressed from seeds used as hair dressing by the Hainanese women; name reported, *Yau ch'a* (油茶), *Ch'a tsai* (茶仔).

Economic specimen of this secured by E. H. Groff on the Canton market under the name of *Ch'a tsai* (茶仔), C. C. C. Ec. No. 155. The price is about 15 cent. per catty L. S. It is purchased in the form of an oil cake. This is used as a hair dressing and also boiled with water and poured on the ground to kill worms.

186.5147—THEA SINENSIS Linn.

Hong Ma Ts'un (康馬村), 8296, Dec. 3, 1921 and *Five Finger Mt., Hop Lo Ts'un* (五指嶺,合羅村), 8357, Dec. 6, 1921; edge of ravine, roadside; alt., 400-800 m.; shrub; ht., 2-3 m.; fls., white fragrant; names reported, *Ching ch'a shu* (正茶樹), *Ch'a* (茶).

186.5147—THEA SP.

Five Finger Mt., (五指嶺), 8324, Dec. 27, 1921, *Hainan, Fan Ta* (海南,番打), 9161, Apr. 19, 1922, *Ka La* (加拉), 9200, Apr. 21, 1922, *Fan Ya* (番也), 9304, Apr. 26, 1922 and *Five Finger Mt.*, (五指嶺), 9486, May 8, 1922, 9576, May 13, 1922 and 9578, May 14, 1922; wooded ravine, edge of stream, shrubby ravine, in thicket, in moist rich earth in wooded ravine; alt., 500 m.; shrub; ht., 2-4 m.; dia., 3-10 cm.; fls., white, brownish, fragrant; frs., blackish brown; leaves used by the Lois to make tea, and considered to have medicinal value; names reported, *Fu ch'a* (苦茶), *T'im ch'a* (甜茶).

186.5153—TERNSTROEMIA JAPONICA Thund.

Five Finger Mt., (五指嶺), 9522, May 9, 1922; wooded ravine; tree; ht,, 7-8 m.; dia., 15 cm.; fls., cream yellow.

186.5156—ADINANDRA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 252

Five Finger Mt., (五指嶺), 9571, May 13, 1922; wooded ravine; shrub; ht., 3 m.; dia , 8 cm.

186.5157—EURYA CHINENSIS R. Br.

Nodoa, Lin Fa Ling (那大,蓮花嶺), 7917, Nov. 2, 1922 and *Five Finger Mt., Fan Ya* (五指嶺,番也), 8399, Dec. 9, 1921; thicket, hillside; alt., 400-1000 m.; tree; ht., 5-7 m.; dia., 10 cm ; name reported, *Mai sui fa* (米碎花).

186.5157—EURYA CILIATA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 253

Five Finger Mt., (五指嶺), 9319, Apr. 28, 1922; wooded ravine; tree; ht., 10 m.; dia., 20 cm.

186.5157—EURYA JAPONICA Thunb.

Five Finger Mt., (五指嶺), 9384, May 1, 1921; in dense woods, tree; ht., 5 m.; dia., 4 cm.

* * *

Errata Pages 9-43.

Page 10, first species. For *Ngau ngan ching* read *Ngau ngan tsing.*
Page 12, first species. For *She pau lak* read *She p'au lak.*
Page 12, second species. Same correction as above.
Page 13, ninth species. For *Ngau cheung ma* read *Ngau ch'eung ma.*
Page 16, second species. For *Ka tin tsing* read *Ka tin ts'ing.*
Page 16, eighth species. For *Kam shu t'ang* read *K'am shu tang.*
Page 17, eleventh species. For *U lo cha* read *U lo ch'a.*
Page 19, seventh species. For 218.3891 read 128.3891.
Page 23, first species. Delete 9449, May 5, 1922.
Page 23, first species. For *Chau shi kat* read *Ch'au shi kat.*
Page 25, fifth species. For *Ap kung t'sing* read *Ap kung ts'ing.*
Page 28, fourth species. For 147.4335 read 147. 4345
Page 29, second species. For an use read and use.

This Enumeration will be
continued in the next
issue of the Review.

HOOKWORM DISEASE IN CHINA AS AN AGRICULTURAL PROBLEM

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Hookworm disease is a public health problem of world wide significance. It is found chiefly in regions with a long, warm, wet season, and in those people who live close to the soil. It is caused by the presence in the intestine of man of small worms (about one-half inch in length) which bite the wall, suck the blood and inject a poison into the system. When in sufficient numbers, these worms cause a disease characterized by weakness, pallor and digestive disturbances. The worms do not multiply in the human body but produce large numbers of eggs, which escape with the feces. When the eggs fall on warm, moist soil they hatch and produce the microscopical larval stages, which usually enter the body through the feet or hands, make their way to the intestine by way of the blood stream and lungs and grow to maturity in about a month.

Since the human hookworm develops only in man, it is spread by contact with places where human feces containing the eggs have reached the soil. In most of the countries within the hookworm belt, this disease is spread by the careless depositing of the stools on the soil near the houses or in the fields. Its control in such places is a problem of rural sanitation and involves chiefly educational measures for the proper disposal of human wastes. In China the problem is entirely different. Here on account of the careful storage and use of night soil in fertilizing the fields, hookworm disease becomes an agricultural problem and the degree to which the hookworm can spread is chiefly determined by the methods of using night soil in cultivating the crops. Under such conditions effective control measures cannot depend on any attempt to discourage the use of night soil in the fertilization of the crops, since on this practice the economic balance of the country depends, and the waste of this valuable material would be unthinkable to the Chinese farmers. Methods of control therefore must develop around the devising of methods of using the night soil, so that living eggs and larvae will not be placed on the fields, and the education of the farmers in the use of such methods. At present there is not enough information available for developing a logical program of prevention, so that the attack on hookworm disease in China is still in experimental stage. It seems worth while, therefore, in this connection to give some analysis of the factors influencing the spread of hookworm disease in China, and to outline the lines of attack.

The factors which influence the spread of hookworm disease in any region belong to two categories, viz.: (1) climatic and (2) those concerned with the habits of the people. Since hookworm eggs can only hatch and the larvae develop in a warm, moist environment, the temperature and moisture conditions influence greatly the prevalence of hookworm disease in any region. In tropical countries the temperature throughout the whole year may be favorable, so that in such regions the period during which the hookworm may be disseminated is limited to the season during which the soil will be kept moist. In subtropical and temperate regions temperature also becomes a limiting factor, and the extent of the hookworm problem will be influenced by the amount of time each year that warm and wet weather coincide. China offers a splendid example of the influence of climatic factors on the distribution of hookworm disease. It is evident that throughout all of China there are areas where the habits of the people are favorable to the spread of hookworms. This is suggested by the methods of use of night soil and by the reports of some infestation from practically every province. The evidence available, however, indicates that in the dry cool regions north of the Yangste Valley, hookworm disease is nowhere a public health problem and that the distribution of the human hookworm is limited to light scattered infestations. I am convinced that this limitation is due not to habits which prevent its spread but to the very short period of the year when conditions are favorable. As far as hookworm disease is concerned, therefore, climatic conditions hold it under control in that vast area of China north of the Yangste river. This same condition undoubtedly exists in the large areas south of the line where the rainfall is scanty or the high altitude makes the temperature low.

Within the belt in China where climatic conditions are favorable for hookworm disease, the degree to which it is present will depend on the habits of the people which bring them into contact with soil on which human feces containing viable hookworm eggs had been placed under conditions favorable for the development and persistence of the infective larvae. Since night soil is so carefully conserved miscellaneous soil pollution apparently can play only a slight role in the spread of hookworms. Some infestation undoubtedly is obtained from places around kongs, etc., where night soil is accidently spilled. It is evident, however, that the great mass of hookworm infestation comes from contact with fields that have been fertilized with nignt soil. We have, therefore, in China the situation that hookworm disease becomes a disease of the farmers and its spread is linked with the methods of agriculture. Also since there are great differences in the fertilization and cultivation of different crops, we would expect to find differences in their relation to the spread of hookworm disease. Investigations are under way on these problems which, while as yet far from complete, have gone far enough to make it profitable to analyize some of the factors involved in the relationship between crop cultivation and hookworm disease and to present some of the problems which are especially related to agriculture.

The most favorable type of conditions for the spread of hookworms by crop cultivation would be those in which concentrated night soil containing large numbers of hookworm eggs was placed during the warm season on fields kept constantly moist under conditions of cultivation which required extensive contact by the farmers either for cultivating or harvesting the crop. Fortunately such conditions, very favorable to the hookworm but unfavorable to man, are seldom realized. Three types of factors determine the extent to which the use of night soil in fertilezing crops spreads hookworm disease. The first of these is the numbers of viable hookworm eggs present in the night soil at the time of application. This would depend on the source of material and the way in which it was handled. Since city people or those engaged in non-agricultural occupations have little if any contact with the fields they are practically free from hookworms. Therefore, as far as hookworm disease is concerned, it is practically safe to use on the fields night soil collected and stored for some time in kongs or storage pits. Exact data is not yet available on the length of time that hookworm eggs will retain there viability under such conditions of storage. Enough information is available, however, so that we know that there is a gradual dying off of the eggs with increased time of storage. There is also the problem of what happens to the hookworm eggs in night soil when it is mixed with other things. An interesting situation develops in those places where the latrines are placed over small ponds, from which once a year the mud is used for fertilizer. While no direct studies have been made on this situation, it seems evident apriori that from such handling of night soil there would be a very great reduction in viable eggs. It will be seen, therefore, that in considering the danger from night soil fertilization both the source of material and the methods of handling must be considered.

The second factor of significance in the use of night soil is whether the condition of the fields on which it is placed is favorable for the development of hookworm larvae. The hookworm larvae are easily killed by drying. Therefore they develop and persist best in those fields which are kept constantly moist by rain or irrigation. Therefore it is during the wet season that the danger is greatest. Concentrated fertilization with night soil during the rainy season of such crops as mulberry or vegetables will permit the development of large numbers of infective larvae distributed over the soil. On the other hand fertilization and cultivation under water as in the case of rice cultivation seems to greatly decrease the danger.

The third factor is the amount of contact of the farmers with the soil of the fields after the use of the night soil. The hookworm larvae require about 6 to 8 days for development and live on the surface of the soil. Methods of cultivation such as weeding or picking of vegetables or the picking of mulberry leaves would under such conditions bring the hands or feet in contact with the soil and make possible the penetration of the larvae.

The above analysis gives some idea of the complications involved in the relation of the fertilization of crops to the spread of hookworm disease, and the type of information needed before control measures can be undertaken in any particular region, where this disease is prevalent. The information needed can be gained in several different ways. A study of the population to determine the distribution of hookworm infestation and the severity of the disease will give important information on the sources of the infestation. A careful study of the methods of fertilization and cultivation of crops along the lines suggested above, will give information in regard to which of them are most important in the spread of hookworms, and may well suggest modifications in method which will reduce the danger. Finally extensive experimental studies on the handling of night soil, in regard to storage and mixture with other materials are needed with the hope of finding methods which will kill the hookworm eggs. Investigations along these lines are being undertaken in China by a commission under the auspices of the Peking Union Medical College with the cooperation of the International Health Board of the Rockefeller Foundation.

The work for Kwangtung province is being carried out by the Canton Christian College with the cooperation of this commission. The work has not yet gone far enough to make it possible to report definite conclusions. It is hoped that these investigations will serve to open the way for more extensive work in various parts of China which will lead to a more thorough understanding of the hookworm problem, and the formulating of definite control measures.

CARBON TETRA-CHLORIDE
in the
TREATMENT OF UNCINARIASIS

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The menace to the health of individuals caused by the presence of hookworms in the intestinal tract has resulted in a search for the ideal anthelmintic. Chloroform, Betanaphthol and Thymol have all been championed in the past until they were in turn supplanted by oil of chenopodium which has been generally recognized of late, as the most effective vermifuge for both ascaris and hookworm.

It is, however, evident that we have not yet discovered the ideal remedy for uncinariasis and any improvement in our means of combating this disease is to be eagerly sought after.

Carbon Tetrachloride or Tetra-chlor-methane is described by Thorpe (1) as a transparent colorless liquid with a pungent aromatic odor.

Its formula is CCl_4 and it has been prepared by the action of chlorine upon chloroform ($CHCl_3$) in sunshine. Its physiological action is similar to that of chloroform. It was discovered by Regnault in 1839.

The first use of carbon tetrachloride for the expulsion of hookworms was by Hall (2) (3). He found .3 cc per kilogram of body weight very effective in dogs. No gross pathological changes were found in the liver, spleen or kidneys of animals which had been treated. In 30 dogs treated, in which the intestines were examined, all hookworms were expelled by this method. He also used a mixture of oil of chenopodium with carbon tetrachloride and of thymol with carbon tetrachloride, given in hard gelatin capsules. In monkeys as much as 6 cc. per kilogram was given without any symptoms except a slight decrease in the appetite for a few days. The drug he found to be of no use for tape-worm and less effective than chenopodium for ascaris.

Hall (4) considers that to human subjects carbon tetrachloride should be given in hard gelatine capsules. It should not be given in or followed by castor oil. If any laxative is necessary magnesium sulphate should be used.

Nicholls and Hampton (5) tried the drug on a murderer. He was given one dose of 6 cc. 20 days and another similar dose one week before execution. The microscopic examination of the organs was negative and all parasites had been expelled.

It was also given to 20 infected students, of whom 90% were cured by the one treatment. The stools were examined on 3 days following the treatment and the greatest number of worms were passed on the second day.

They recommend 10 mimins (.6 cc) for a child of one year and an increase of two mimins (.12 cc) for each year of a child's age.

The adult does is from 50 to 80 mimins (3 to 5 cc.)

They emphasize the following advantages of carbon tetrachloride over other remedies used:—

1. Patients do not object to the taste.
2. It is more efficient than chenopodium and less depressant.
3. It is unnecessary to use a purge.
4. It is the cheapest of all remedies.
5. It is easily prepared in pure form.
6. Persons under treatment do not have to give up a days work.

Hampton (6) states that a 1.5 cc. dose of oil of chenopodium gives microscopic cures in from 30 to 50% of patients treated, while one 3 cc dose of carbon tetrachloride gives microscopic cures in 90% of cases treated and costs only one tenth as much as chenopodium. The salt flotation method for examination was used.

The present study has been carried out as part of a program of investigation into the prevalence of hookworn infection among workmen at the Canton Christian College, and a study of the viability of hookworm larvae in night soil and means of rendering the night soil safe for fertilizing vegetables, etc.

This work is being undertaken by the joint cooperation of the department of Agronomy, Biology, and Medicine of the College and the Health Service of the Canton Hospital. Work was commenced by Dr. F. Oldt of the Canton Hospital and Mr. A. S. Champbell of the Canton Christian College.

A preliminary report (7) has already appeared. The feces of all the workmen employed by the department of agriculture were examined either by the salt-flotation method as suggested by Kofoid or by the Willis salt-flotation method. This latter method, because of its simplicity and delicacy, was found especially valuable.

The majority of the men had been farmers before entering the employ of the College. Altogether 172 men were examined for ova of Uncinaria. 119 or 69% of these proved to be positive and 53 or 31% negative. 35 of these cases examined by the Willis flotation method gave a percent of 80 positive. It was decided to undertake to cure all infected men and to experiment with the new anthelmintic as compared with oil of chenopodium.

The men were treated in batches of from 2 or 3 up to 10 or 15 at a time and were sent to a separate matshed the night before treatment, after they had had their supper. The next morning the medicine was given on an empty stomach followed in about 3 hours by an ounce of castor oil. They were allowed to take congee at noon and the regular meal in the evening, and were excused from work for 2 days.

Oil of chenopodium was given in capsules, the entire dose being 3 cc. divided into 3 doses at hour intervals.

Carbon tetrachloride was given in doses of 3 to 6 cc. floated on about 20 cc. of water. In the first treatments a preliminary dose of magnesium sulphate was given but this caused rather excessive purging when followed by the carbon tetrachloride so that in the subsequent treatments no preliminary purge was given. In some cases there was no bowel movement until castor oil had been taken, although in the majority of those treated with carbon tetrachloride the following purgative was found to be unnecessary.

The men were unwilling to resume work without 2 days rest for the treatment. They claimed that they were not feeling well enough on the day following treatment. This may have been laziness. No case was severely infected, that is none considered himself in any way a sick man before treatment and all were doing full work in the gardens and on the farm. There were, however, a number quite heavily infected.

The carbon tetrachloride used was purchased of A. S. Watson & Co., Ltd., in Canton. Upon inquiry I found that the drug was a "technical quality" purchased of the American Drug Co. in Shanghai and imported by them from McKesson and Robbins of New York. It was tested in the Chemical Laboratory of the Canton Christian College and was found to be free from phosgene and other poisonous substances.

Table I. gives the results of treatment in 72 cases. Although 119 cases showed hookworm ova and most of these received treatment, many of them were not examined after one treatment and therefore the results are not known:—

TABLE I.

Total rendered negative	57
Treated, but not cured after one or more treatments	15

The cases that were cured were treated with chenopodium alone, or carbon tetrachloride alone, or with one of these remedies followed subsequently by the other. As a rule the stool was not examined for 18 or more days after the previous treatment, and in case ova were present a second treatment was given. In Table II. the treatments required in the 57 cured cases are noted.

When we come now to analyze more closely the comparative results of carbon tetrachloride and oil of chenopodium, we find that the claim made for the former by Hampton and others that a single dose of 3 cc. will give a complete cure in 90% of cases is not borne out by our figures. See Table III.

In 31 cases treated once with 3 cc. of oil of chenopodium 58% were cured and 42% remained positive.

In 36 cases treated with one dose of carbon tetrachloride from 3 to 6 cc. 36.1% were cured and 63.9% remained positive.

Thus it appears that oil chenopodium in 3 cc. doses is considerably more efficient than carbon tetrachloride.

We can offer only two possible explanations for the apparently poor results of our use of the drug as compared with those of other writers. Either the drug was not of good quality and full strength, or by the Willis flotation method infection can be detected which escaped the observation of the authors quoted.

It is our purpose to secure more of the carbon tetrachloride in order to further test its efficiency as compared with the other anthelmintics.

SUMMARY.

1. A group of 172 Cantonese farmers working in the Agricultural Department of the Canton Christian College showed infection with Uncinaria of 69%.

2. One treatment with 3 cc. of oil of chenopodium caused a cure in 58% of cases.

3. One treatment with from 3 to 6 cc. of carbon tetrachloride caused a cure in only 36.1% of cases.

Table II.

Treatments used in 57 cured Cases of Uncinariasis. Treatments were given one or more weeks apart.

Drug Used in First Treatment.	Drug Used in Second Treatment.	Drug Used in Third Treatment.	Drug Used in Fourth Treatment.	No. of Cases Cured.
Ol. Chen. 3 CC.				18
Ol. Chen. 3 CC.	Ol. Chen. 3 CC.			1
Ol. Chen. 3 CC.	Ol. Chen. 3 CC.	Ol. Chen. 3 CC.		1
Ol. Chen. 3 CC.	CCl_4. 4 CC.			3
Ol. Chen 3 CC.	CCl_4. 5 CC.			5
Ol. Chen. 3 CC.	CCl_4. 5 CC.			1
Ol. Chen. 3 CC.	Ol. Chen. 3 CC.	CCl_4 5 CC		1
Ol. Chen. 3 CC.	CCl_4. 5 CC.	CCl_4 6 CC		1
CCl_4 3 CC.				1
CCl_4 4 CC.				10
CCl_4 5 CC.				2
CCl_4 3 CC.	Ol. Chen. 3 CC.	Ol. Chen. 3 CC.		3
CCl_4 3 CC.	CCl_4 4 CC.			1
CCl_4 4 CC.	CCl_4 5 CC.			2
CCl_4 4 CC.	CCl_4 4 CC.			1
CCl_4 3 CC.	Ol. Chen. 3 CC.			1
CCl_4 4 CC.	Ol. Chen. 3 CC.			1
CCl_4 3 CC.	CCl_4 5 CC.	CCl_4 5 CC.		2
CCl_4 4 CC.	CCl_4 5 CC.	CCl_4 5 CC.		1
CCl_4 4 CC.	CCl_4 5 CC.	CCl_4 5 CC.	CCl_4 5 CC.	1

TABLE III.

Analysis of Treatments Used in Cases of Uncinaria.

One Treatment with Ol. Chen. 3 CC.	18	13
Two Treatments with Ol. Chen. 3 CC.	1	3
Three Treatments with Ol. Chen. 3 CC.	1	0
One Treatment with $C\,Cl_4$ 3 CC.	1	9
One Treatment with $C\,Cl_4$ 4 CC.	10	12
One Treatment with $C\,Cl_4$ 5 CC.	2	2
One Treatment with Ol. Chen. 3 CC and one with $C\,Cl_4$	9	2
One Treatment with $C\,Cl_4$ followed by one with Ol. Chen. 3 CC.	2	5
After two Treatments with $C\,Cl_4$	4	7

REFERENCES.

1. Thorpe, E. Dictionary of Applied Chemistry. Longman's Green & Co. 1921 Vol. II, P. 70
2. Hall, M. C. Jour. Agricult. Research. Vol. 21, No. 2, P. 157. 1921
3. Hall, M. C. Jour. Am. Med. Ass. Vol. 77, P. 1641. 1921
4. Hall, M. C. Am. Jour. Trop. Med. II. P. 373. 1922
5. Nicholls, L. and Hampton, G. G. Brit. Med. Jour. II, P. 8, July 1, 1922
6. Hampton, G. G. Am. Jour. Trop. Med. II No. 5 P. 381. 1922 Quoted Jour. Am. Med. Ass. 79, P. 1636. 1922
7. Oldt, F. and Campbell, A. S. Lingnaam Agricultural Review, Vol. I, No. I, P. 80.

HOOKWORM INVESTIGATIONS IN CHINA

Much good for the welfare of this nation should result from the hookworm studies now being carried out in various parts of the country by Dr. W. W. Cort, world specialist in parasitology of the Johns Hopkins School of Hygiene and Public Health. The Program launched in China is under the joint auspicies of the Department of Pathology of the Peking Union Medical College and the International Health Board of the Rockefeller Foundation. Dr. Cort is ably assisted by Dr. S. B. Grant and Dr. Stoll and by two Chinese doctors and a number of technicians. The field work on the present project will close Number 30, 1924 and the main field laboratory is in Soochow. Work has also been set up at Chefoo, Wuchang and Canton. Dr. Cort's recent visit to the south has greatly stimulated efforts here. There are at least three phases of the program.

The first of these is to make a general survey of hookworm infestation and hookworm disease in China. There are three general sources for information: (1) from literature, (2) from medical missionaries and other agencies and (3) by egg counts, many thousands of which have already been made.

The second portion of the program includes a study of the epidemiology of the hookworm. The hookworm disease is an occupational and rural problem. For example studies to date have revealed that in the Soochow area the cultivation of mulberry is admirable favorable for hookworm infestation. On the other hand, contrary to general belief, it is not so with lowland rice as hookworm eggs cannot hatch in water. Investigations have shown that the hookworm is not a public health problem north of the Yangtsz valley. Climate and methods of cultivation and fertilization of the fields are largely responsible for the spread of hookworm.

The third part of the program includes the attempt to discover the actual life record of hookworm in storage and under various methods of handling the night soil. A most amazing conviction which Dr. Cort expresses in that if the night soil in China was not used on the fields, hookworm disease might be even more common than it is; for, with unsanitary lavatories miscellaneous soil pollution would surely result. In the study of the wet storage of night soil the point is to find out the period of life of the hookworm in such storage. For example, at Soochow the clinical hookworm situation is very bad and the disease so prevalent that the common people readily recognize it and call it "mulberry yellow". The great problem is under what conditions of storage will it be safe. Or stated in another way what is the relation of mulberry cultivation to hookworm infestation? Dr. Cort carried out similar studies in vegetable cultivation in South China.

It is in the third part of this program that the Ling Nan Agricultural College believes it has a contribution to make and Dr. Cort has expressed a desire to leave this part of the work almost entirely to us.

When agricultural work was begun at the Canton Christian College about fifteen years ago this problem received the earnest consideration of the college specialists in agriculture and medicine. But it is only since Dr. Frank Oldt of Canton Hospital and United Brethern Mission has devoted a considerable portion of his time to a thorough study of the problems involved, that systematic experiments have been set up on our farm. Mr. Edward Shim of the Department of Agronomy and Dr. W. W. Cadbury, College Physician, have been working in close cooperation with Dr. Oldt. If sanitary methods of storage or treatment of night soil, which will prove more satisfactory and efficient to the Chinese farmer than present methods, can be found, there will be no question as to the success of a widespread program for hookworm prevention in China. We hope to publish in a forthcoming issue of the Review a preliminary report by Dr. Oldt of some of the findings. We are publishing in this issue an article on this subject by Dr. Cort and one by Dr. Cadbury. Dr. Cort has also published a popular article in our Agricultural Monthly (Chinese) Vol. 2, No. 9, including outlines for information from those interested. This article has had a wide circulation among the Chinese.

CHRISTIAN FORCES AWAKENING TO THE NEEDS OF RURAL CHINA.

by

G. W. Groff

In February two important conferences were held at Nanking, both of which indicate the more intelligent interest now being taken by missionaries to China and by the Church of China in the needs of China's rural population. The first of these conferences was that of the Committee on Agricultural Education of the China Christian Educational Association which was held February 8 and 9. This was followed, February 9 and 10, by the Rural Church Committee of the National Christian Council. At the first conference more than forty were in attendance, at least half of whom were agricultural missionaries. With them were men and women, from theological schools and missions, who are eager to push forward this new line of work in their districts. The purpose of the meeting of this committee was to formulate and carry out, as far as possible, the suggestions of the Educational Commission to China which looked to the coordination of all Christian agricultural educational work and the working out of an All-China agricultural program. Two important items before the conference were the promotion of the right type of rural education and the formulation of a policy for rural reconstruction by means of some village improvement program. It was evident that it will be very difficult to accomplish the latter without adequately training a large group of men ank women who will conscientiously devote themselves to the country. The Rural Church Committee in the second conference expressed the conviction that students in China, especially those who are above middle school grade, have the tendency to neglect the importance of rural work resulting in the fact that the living conditions of the farmers are becoming worse and worse because they cannot get the right kind of men to be their teachers and to help them solve their problems. In both committees the development of rural school-teacher leaders, sometimes referred to as the teacher-evagel'st of teacher-preacher, was fully considered.

It was the feeling of the subcommittee on training centers for rural workers that one objective in rural teacher training should be to turn back into the Christian primary schools teachers who can not only teach but who will be able to link up the school with the interests of the community, through student projects and adult extension work. The colleges did not seem to be the place for the full development of this idea and it was recommended that several existing middle or normal schools be developed as strong centers for this rural teaching training. In the month of May the Advisory Council of the China Christian Educational Association approved of Wuchang, Nanking, Kaifeng and Weihsien as centers for the promotion of this idea. This rapidly developing program is of great significance to future rural betterment.

The subcommittee on village improvement program, while recognizing the immensity of the problem, recommended that it should be the policy of mission stations to organize one or more specific units of village work on the sample basis, striving in this pioneer field to set an example on what may be accomplished later on a more extensive scale. To this end they recommended that emphasis should be placed in the summer or short courses, training pastors and teachers in specialized methods of rural service. These should be supplemented by courses in agriculture and education. One of the interesting phasis of the problem of farmers' education is that of the writtan language. More thorough investigation of the relative merits of the different phonetics like the National Phonetic System, the Wang-Peill Phonetic and the One-Thousand Character System must be made before the needs can be fully met.

The subcommmittee on extension work reinforced these ideas by recommending that all country workers should be given special rural training in order to acquire efficiency in their work; that more rural schools be established in connection with the rural churches, and that the ones already existing be improved by means of school gardens, nature study, demonstration home and farm projects and school nurseries; that short courses be given to farmers during dull seasons of the year; that rural surveys be made; and that the farmers be more thoroughly organized. The agricultural colleges were asked to write pamphlets in sufficiently simple language that the farmers can read and understand.

The subcommittee on the curriculum for rural primary schools urged the preparation of a simplified form of curriculum based upon the needs of a one teacher school. They recommended that the guilding principle in the selection and arrangement of the curriculum should be that which will contribute most directly to the students efficiency as a rural worker, to his enjoyment of rural conditions and to his ability to lead in public enterprise rather than, as so often, to the preparation for Middle School entrance. Detailed recommendations regarding courses were also submitted, including those for nature study and gardening. Instruction in the latter courses will be guided by a new elementary text book in agriculture with teachers' manual soon to appear in Chinese, publised by Edward Evans & Sons. The book has been prepared by Mr. J. B. Griffing who had experience in rural normal training work before coming to China.

The subcommittee on an All-China program recommended that for the present Colleges of Agriculture should be established only in South China (Canton), North China (Peking) and East China (Nanking); and that in Fukien and West China emphasis for the present should be laid on courses in rural education, rural sociology, and rural economics and on agricultural extension and research, coordinating so far as possible with the agricultural work at Canton Christian College and the University of Nanking. They supported the recommendations regarding centers for rural teacher training and urged that all present middle schools, with student bodies largely rural and serving country districts, should introduce agriculture in order to give their students a sympathetic rural out look.

They emphasized the importance of qualified students entering the Colleges of Agriculture with the idea that after graduation they can relieve the necessity of western agriculturalists for much of the work outlined in the present program. The report of the subcommittee on financing an All-China program was referred to the Executive Committee for their consideration and suitable action when budgets are at hand.

The Rural Church Committee of the National Christian Council, fully approved of this program and they are inaugurating a "back to the farm" movement by asking all the Christian papers to publish sometime this fall a special number on the study and problems of rural work. In 1925 they also propose to ask all summer conferences including those of students, teachers and prechers, to adopt rural work as the main theme of their conference. They also hope to secure from the West in 1925 the special service of experts in rural work. The Committee believed that the faculties of the different theological seminaries in China should realize the importance of providing rural preachers with more specialized training. In order to accomplish this they recommended that different seminaries in China should establish a separate department of Rural Church Life. They further suggested courses in rural sociology and rural community life and urged that a suitable man be called to the faculty for this work. The official organ of The National Christian Council of China, "China for Christ", devoted an entire issue, Bulletin No 41, to the rural church program discussing in Chinese, at considerable length, such subject as: (1) The Country Movement, (2) Plans for Rural Reconstruction, (3) The Relation between the Rural Church and Religious Education and the Medical Profession, (4) Extract from the Recommendations of the Rural Church Committee of the National Christian Council and miscellaneous news items.

So little accurate data is at hand concerning the social and economic conditions of the farmers of China or of the biological and physical problems which they face in their daily work, that Christian forces are greatly handicapped in their will to serve rural China. In this connection it is interesting to note that The Chinese Recorder, the official organ of the coordinated Christian forces, has recently published an editorial on "The Researcher in China" and an article, "Organizing for Scientific Research in China" by Dr. Charles S. Gibbs of the American Board who is Professor of Bacteriology and Hygiene at University of Nanking. In a recent Y. M. C. A. General Secretaries' Conference very strong endorsement was given to the idea of more reseach on the part of Association worker, and plans, looking to this end, are now being laid. Prof. C. H. Robertson of the Educational Department of the National Committee is keenly interested in seeing that intimate relationships are developed and sustained between the Association and the Christian Colleges along research lines. Very good results will inevitably come from this program and we hope that the Association, heretofore primarily interested in urban China, will not fail to realize the dependence of the city upon the country.

NOTES

Canton Agricultural Exhibit: The plans for an agricultural exhibit to be held in Canton are under way. This exhibit will be giver under the auspices of the Kuo Min Tang party and will begin on the 17th. of October and last for ten days. It is understood that three farmers from each farming village in the province will be appointed and entertained as delegates to the exhibit by the Kuo Min Tang people. The idea of the exhibit is two-fold; to teach the farmers better methods of farming and to instruct them in the principles of the party.

The Canton Chapter World Agricultural Society.

The Chapter, since its organization a year ago, has had a number of interesting meetings in Canton. At the last meeting, April 10, 1924, Dr. W. W. Cort, of the Peking Union Medical College, gave a talk on "Hookworm and its relation to Agriculture". Dr. Oldt is connected with the United Brethern Mission and Canton Hospital and has inaugurated and developed the special hookworm programs which is being carried out at the Canton Christian College. A lecture illustrated with moving pictures was given by Dr. Cort at the Y. M. C. A. to which the public was invited. It was attended by several hundred people. The Chapter has a membership of about thirty and its officers are Mr. T. T. Chang, President; Mr. C. K. Cheung, Secretary; and Mr. To Shue Tsoi, Treasurer. Mr. Chang is connected with the Kwangtung Agricultural College, and Messre. Cheung and To are with the Ling Nan Agricultural College, Canton Christian College.

Ling Nan Nursery in Chiuchow Fu

Preliminary negotiations have been made with the Han River Conservancy Board and the Swatow officials for the establishing of a nursery in the Chiuchow district as part of the work of the Ling Nan Agricultural College sub-station work in the Swatow region.

Chung Wing Kwong in America

Mr. Chung Wing Kwong, Associate President of Canton Christian College, who is in America in the interests of the Ling Nan College of Agriculture, has to date been very successful in interesting the Chinese in the support of the Ling Nan Agricultural College. This is the third time Mr. Chung has visited the United States where he has travelled widely. On this trip he has also visited Cuba and Canada and before his return will proceed to South America. Mr. Chan Tsap Ng of the Canton Christion College staff has also proceeded to the United States to assist Mr. Chung.

Pan Pacific Food Conservation Conference

Messrs. C. K. Cheung and C. O. Levine of the Ling Nan Agricultural College and Mr. C. H. Zen of Nanking, are delegates tc the Pan-Pacific Food Conservation Conference to be held in Honolulu, July 31 to August 14. No doubt others from China will be in attendanc at this important conference. The calling together of experts from all lands of the Pacific for discussion of common problems is an excellent idea, and for which credit is largely due to the untiring efforts of Alexander Hume Ford, Director of the Pan-Pacific Union. The agenda for this conference is as follows:

International Law
Fish and Fisheries
Economic Entomology
Plant Pathology
Plant and Animal Quarantine
Crop Production & Improvement
Forestry and Climatology
Food Transportation & Distribution
Topography, Land and Sea
Animal Industry

Ling Naam Agricultural Company

An agricultural company, known as the Lingnaam Agricultural Company, has recently been formed and is acquiring property on Honam Island just west of the Canton Christian College. Fifty-seven mow of land been purchased and grading and fencing has begun. Papaya and forage crops will be grown on land not needed for buildings. A barn plan for housing sixty-six cows has been prepared and as soon as these are approved building will be built. The first business of the Company will be dairying, and as soon as possible the manufacturing of candied ginger and other food products will be initiated. There is no organic relation between this Company and the Ling Nan Agricultural College but the agricultural staff of that institution will act in an advisory capacity.

Forestry and Animal Husbandry

In a recent trip to Peking the editor made observations on Agriculture and Forestry conditions. Travelling by rail from Nanking through Tientsin to Peking late in the winter one is struck by the flat, barren country, with its absence of hills, as compared with Southern China. Wheat, Kaoliang and millet are among the chief crops grown. Near Tientsin persimmon and pear orchards are frequently seen. Near Peking what at first appears to be a thin covering of snow on the barren fields, on closer inspection is found to be white alkali which in many fields is present in such amounts as to render the soil unfit for crops of any kind.

So much has been said about the importance of reforesation in certain sections of this region as a means of preventing floods that a visitor to the region for the first time is surprised to find, in nearly all this wide strip of territory, so little hilly land suitable for extensive tree planting as a means of lessening damage by floods.

The scarcity of hilly grazing land and lack of sufficient rainfall much of the year in this region will prevent livestock production and reforestation from becoming extensive industries as compared with the west and north-west, and especially with Southern China with its 50 to 100 inches of stimulating, sub-tropical rain each year, and abundant hilly land, where trees make rapid growth and grass grows abundantly and is available for grazing twelve month of the year.

In the past South China has permitted the North to do all the agitating for livestock and forestry promotion. The South should awaken to its possibilities in these two industries. Much of the famine problem of China will be solved when the extensive hills and plains of Southern China, as well as of North-west China and Mongolia, are made to produce food and fuel as the possibilities indicate, and when the railway between Canton and Peking is completed, making possible rapid transportation of these products in times of food scarcity in the North.

Agronomy, Ling Nan Agricultural College

A number of varieties of rice have recently been received from America, the Philippine Islands, Java, Siam, Tonkin, and the Federated Malay States. Chinese varieties of rice have also been received from the Second Agricultural School in Kiangsu, Rice Experiment Station of the National Southeastern University, and from Kiungchow, Hainan Island.

Varieties of our own rice were sent to the following: Louisiana Rice Experiment Station; Kiangsu Provincial Rice Experiment Station; and Second Agricultural School, Kiangsu.

Seventeen varieties of velvet beans have been received from the Florida Agricultural Experiment Station for trial here. All these have been planted, together with two varieties introduced some time ago from Hawaii.

The Hawaii Agricultural Experiment Station has cooperated in sending us their publications and seeds of tropical crops. Recently seeds or cuttings of the following crops were received: No. 1486, Pennisetum setosum; No. 1098, Molasses grass (Milinis minutflora); No. 1281, Merker grass (Pennisetum merkeri) No. 793, Australian water grass (Paspalum dilatatum); No. 1002, Napier grass. These are now growing in experimental plots.

In connection with, and as a supplement of the Provincial Sericulture Survey carried out by the Sericulture Department, the Agronomy Department undertook that part of the survey which deals with the uses and practices of fertilizer in the production of the mulberry. The mulberry regions of Yungki, Kwaichow, Tai Leung, and Siulam were visited. The findings of these investigations are embodied in a report which will possibly appear in the next issue of this Review and will later be incorporated in the report of the Provincial Sericulture Survey.

The department is carrying on several fertilizer experiments in cooperation with commercial fertilizer companies. The Ammo-phos experiment with lowland rice, which was completed last November, showed interesting results. Fertilizer experiments are now being carried on with rice (upland and lowland), mulberry, peanut, and tomato. There are 20 plots, each 1/20 of an acre, of lowland rice fields now under test with chemical fertilizer.

Visitors at Ling Nan

For about seven weeks in February, March, and April we greatly enjoyed and profited from the stimulating influence of Dr. W. W. Cort of the Peking Union Medical College and Johns Hopkins University. Dr. Cort's world-wide experience in the fields of hookworm investigations enables him to quickly grasp the fundamental issues at stake in our night soil studies. His work at the college has resulted in a more efficient organization of our projects and the more thorough training of our men. His advice regarding future developments has been most beneficial and we are indebted to both Dr. Cort and the organizations he represents for the privilege of the time he has given this work in South China. We trust Dr. Cort will be able soon to arrange for a visit from Dr. Stoll who is associated with him in Soochow. Details regarding the investigations are fully recorded in the pages of this issue of theReview.

Mr. Gist Gee of the China Medical Board spent about a week at the college in the month of February. Mr. Gee is fostering biological education in China and is helping very greatly in the coordination of effort in this important field. He has recently issued lists of biological books found in the libraries of colleges in China. Mr. Gee is also promoting the Summer Institute for Science Teachers to be held at Tsing Hwa College July 8 to August 5, 1924 under the auspices of the National Association for the Advancement of Education. While Mr. Gee is primarily interested in this work from the medical side he does not fail to realize its importance to agricultural education as well.

Sir Arnold Theiler, Director of Veterinary Research and Education for British South Africa, was the guest of Mr. C. W. Howard with whom he was formerly associated in South Africa. On the morning of December 26th Sir Arnold delivered a most interesting lecture on Veterinary Science with special reference to organization and service in South Africa.

In January Mr. and Mrs. J. Struthers visited the college while on a short inspection trip of fertilizer conditions in South China. Mr. Struthers is Director and Manager of the Frazer Trust Co., Ltd., and representative of the Chilean Nitrate Producers Association ot Japan. Mr. Struthers showed a deep personal interest in the work of our college and was much impressed with the significance of our agricultural program. He has made it possible for us to undertake special experiments in fertilizing mulberry and in seed selection work.

In March Mr. Victor M. Buck, agricultural missionary of the Presbyterian Board, stationed at Ebolowa, Cameroun, West Africa, spent a week with us en route from America to his station. Mr. Buck is a brother of Mr. J. Lossing Buck of the College of Agriculture and Forestry of the University of Nanking and has had an unusual opportunity to study the work of agricultural missions in China. Agricultural missionaries are now widely scattered throughout the world and visits with one another bind them closer together in their common service.

Mr. W. Floyd Carman of the China Commercial Company paid a short visit to the college in April. This company is one of the largest importers of fertilizers in southern China and a number of Ling Nan men hold important positions in the company. Mr. Carman is also much interested in securing a large number of ducks from North China for introduction to the duck farms on Long Island. He has asked Mr. Levine to assist in investigating possibilities in this direction.

Mr. J. W Walsh, Commissioner for Chinese Affairs in New Zealand, and Mr. Chan Dat Chee, retired merchant from New Zealand, recently visited the college and have offered to present to the college several dairy cows from New Zealand.

Mr. Julean Arnold, American Commercial Attache at Peking, and his son Mr. Millard D. Arnold, visited Canton in March and spent some time at the Canton Christian College. Mr. Arnold fully appreciates the importance of agriculture to the commercial life of China and is especially interested in our sericulture program. He is also urging the Fukien Christian College and Canton Christian College to devote some effort to China's wood oil industry.

Mr. F. R. Wulsin, explorer for the National Geographic Society, paid a short visit to the college, April 2, when he fully reviewed our botanical work and arranged for a cooperative project in field collecting in Kwangtung. Mr. Wulsin was en route to Indo-China and Yunnan. We look forward to seeing at an early date the accounts of his travels in China in the National Geographic magazine.

Dr. J. F. Rock, formerly Professor or Systematic Botany of the University of Hawaii, arrived in Canton, en route north and to America, April 25. Dr. Rock is now connected with the United States Department of Agriculture as Plant Explorer and Botanist for the Office of Foreign Seed and Plant Introduction. He has just returned from two and one half years in Yunnan and southeastern Tibet, and gave us a glowing impression of the beauties of our hinterland. Much interest is now being shown in this region by plant explorers. Dr. Rock was in search of blight resistant chestnuts but collected widely. It is hoped that he will deposit some of his material in our herbarium. On Saturday morning, April 26th, Dr. Rock spoke to the agricultural students and faculty upon the subject of botany and plant collecting.

Mr. & Mrs. O. D. Frost and son, of New Jersey, paid a very short visit to the college and spent a day with Mr. Howard in the delta, studying silk production. Mr. Frost is President of the Champlain Silk Mills and is an active member of the Silk Association of America. It is the visit to China of men like Mr. Frost which is giving to the silk interests a more intelligent understanding of the infinite problems of the rearers of these millions of worms which must each year be kept free from disease and carefully fed in order that one of the most beautiful and delicate fabrics can be produced in sufficient quantity to meet the world's needs.

Mr. & Mrs. Charles J. Huber spent ten days with us in the month of June. Mr. Huber is Eastern Manager of the United States Testing Company, Inc., of Shanghai and is intimately associated with the interests of the American Silk Association in China. Mr. Huber's visit to South China was primarily to make a final study of the plans and inaugurate the building program of the Eugene Atwood Reeling Laboratory and to advise in the development of our sericulture program. Mr. & Mrs. Huber also made a trip into the delta with Mr. Howard. We look forward to another visit from Mr. & Mrs. Huber in the fall, when we hope the new laboratory will be well under way.

In June Dr. S. M. Shirokogoroff, Anthropologist of the Museum of Anthropology and Ethnography of the Russian Academy of Sciences at Petrograd, spent several days at the College. Dr. Shirokogoroff is making anthropological and ethnographical investigations in China, with a view to discovering the origin of the Chinese and has carried out surveys in Eastern Siberia, Manchuria, Mongolia, and various parts of China. His trip to South China was with the purpose of taking measurements of the Cantonese in Hongkong and Canton. Dr. Shirokoroff has written some very instructive papers on this and allied subjects, including one on "Growth of Chinese", in the China Medical Journal of May, 1924 and "Social Organization of the Manchus," published as Extra Volume III of the North China Branch of the Royal Asiatic Society.

Some other recent visitors to the college, who showed keen interest in our agricultural work, have been: Dr. & Mrs. Salisbury of Hainan, Mr. & Mrs. W. A. Rogers of Buffalo, N. Y., Dr. & Mrs. Linnaeus E. La Fetra of New York City, Mr. George K. King of Boston, Mass., Mr. & Mrs. R. E. Olds of Lansing, Mich., Miss Edith M. Hadley and Mrs. Arthur Ellis Hamm of New York City., Mr. & Mrs. Horace A. Carter and Mrs. Mercy Carter of Boston, Mass., and Dr. & Mrs. D. A. Herbert, botanist at the College of Agriculture at Los Banos, P. I.

Present Condition of the Silk Industry in Kwangtung.

The sericulture industry of this province is passing through a very critical period of its development. In years past there has usually been a very brisk trade in Canton silk. During the war there was an increased demand in spite of the fact that there were many complaints as to the inferior quality turned out by our filatures. Early this year, however, Canton received cable advice from America that Canton silk was greatly in disfavor, primarily because of our poor reeling methods, and that the demand this year would be slight. This caused a panic on the local silk markets and for a time there was much discussion as to the situation. In some quarters American merchants were blamed for the unusually high prices which obtained last year and for the fact that all too often they pay the same price for poor quality as for good quality silk. False rumors were intensified until it was even reported that the United States had prohibited by law the entry of Canton silk. The result of all this was that for the first crops this year there was a terrible slump in the industry. At the opening of the year it was reported, quite authoritatively, that in Shuntak district, where there are nearly 200 filatures and 60,000 women and girl laborers employed, about two-thirds of these were forced to suspend operations.

At this writing three of the six crops produced each year have been completed. The latest reports of the market for Canton raw silk indicate that the price has risen to $1,100 to $1,200 per picul, but that buying is very slow at even lower prices. Very few orders are coming through from America. This low price for raw silk is still holding down the prices offered for cocoons with the result that many farmers are attempting to go into rice culture or vegetable growing instead of silk worm rearing. The egg markets for the fourth crop gave a clear indication of the state of mind of the farmers. In some cases egg sheets were selling as low as twenty cents for nine sheets. Many egg merchants were forced to throw their entire output into the river as they could not sell at any price. The low condition of the market was still further accentuated at this time by the severe floods which had covered the Shuntak, Heungshan, and Namhoi districts, and by the presence of an epidemic of the '' mo chung'' (毛蟲)—the larva of a ''tussock moth'' (*Porthesia similis,*), which had already destroyed at that time fifty percent of the mulberry leaves.

The Sericulture Department of the College is this year continuing with its efforts in the distribution and sale of disease free silkworm eggs. The department has produced during the past fiscal year 2,180 commercial sheets of silk worm eggs and 44,561 inspected circles of eggs. For the production of these we have produced on our own farm about half of the mulberry leaves required Work has been begun upon the Eugene Atwood Reeling Laboratory, a building badly needed for a long time and now made possible through the generosity of Mr. Eugene Atwood of the Atwood Machine Company, Stonington, Connecticut. In this building there will be installed a cold storage plant, the gift of Mr. Edward E. Bradley of the same company.

Horticulture.

The Horticultural Department has had an unusually successful year in its work of flower, vegetable, and fruit production, and seed and plant distribution. The new pumping plant installed by the college this year has made production during the dry, winter season more of a certainty than heretofore. In addition to providing for local needs at the college we have had liberal supplies of vegetables for the city markets. Our vegetables are in great demand by both Chinese and western households and it is our aim to increase production to the point where we can more nearly meet the demand.

A decided increase in production has been noted from the papaya grove this year. We have produced in the twelve months from July 1, 1923, to June 30, 1924 nearly 20,000 pounds of fruit. Seeds and plants have been widely distributed and the Ling Naam papaya is now well established. No attempt has been made to advertise the value of papaya fruit and we are confident that with such effort a large market could be created. This, however, is not our function and we await the activity of some progressive Chinese fruit grower who will see the opportunity.

Another very successful introduction which we have now established is the eucalyptus tree. Prior to our efforts sporadic attempts to introduce the eucalyptus into Kwangtung had been made by various individuals, and a few scattered trees, of various species, could be found. One of the former chief engineers of the Canton-Hankow Railway, a Mr. Williams, during his term of service on the construction of this line up the North River, had become a eucalyptus enthusiast and it was he who urged us to make a more systematic study of the possibilities. During the past ten years we have tested many species and under our local conditions find only two or three of any great promise. One of these is *Eucalyptus robusta*, the Brown Gum or Swamp Mahogony, of which we have many fine specimens on our campus and from which we are now collecting seed in considerable quantity. During the past year we have sent to various parts of the province more than 7,000 well developed trees, averaging three feet, most of which were pot grown so as to reduce the risks in transplanting. The eucalyptus will make a valuable addition to the trees of South China as the price of firewood has steadily risen during recent years and production should be greatly increased, especially near the large cities. This tree is admirably adapted for this purpose. The interest shown in eucalyptus in the Swatow region is apparent by the fact that we have recently received a request for 20,000 seedlings and 25 pounds of seed.

This has been a very unfavorable year for lychee. Last year we produced from our own trees about 2,000 pounds whereas this year we have but several hundred pounds. Prices on the Canton markets are very high and there seems to be an unusually poor crop throughout most of the province. We had hoped to carry our studies of the lychee into Fukien province this year but have been prevented by shortage of staff. As yet we have not been able to accomplish much in a program of better lychee progagation because of lack of the greenhouse facilities necessary for the work. Mr. Kwok Wah Shau and Mr. Taam Sik Hung have been working upon a translation and revision of Mr. Groff's book, *The Lychee and Lungan*, which should appear in Chinese during the coming year.

Educational Activities, Ling Nan Agricultural College.

This year we had one candidate, Mr. Yung Ping Hang, for the degree of Bachelor of Science in Agriculture. This was granted at the regular Commencement and Closing Exercises of the College held in Swasey Hall, June 24. At the same time Two-Year Junior Certificates in the Agricultural College were granted to twelve men. Short Course (One Year) Certificates were presented to eleven men.

Ling Nan Agricultural College Staff.

It is with deep sorrow that we record the death of Mr. Lei Sz Ying which occurred at the close of the year 1923. Mr. Lei was a graduate of the Canton Christian College Middle School and later a B. A. from the Young Men's Christian Association Training School, Chicago. Mr. Lei was Instructor in Rural Sociology and the Executive Secretary of the Board of Managers. He was an active worker for the interests of our college and was especially eager to raise sufficient funds for our agricultural building. Mr. Lei was a thorough student of the functions of an agricultural college and fully understood the social significance of that which we are attempting to do. His death is a great loss to our work.

Mr. Edward Shim who has been in charge of our Department of Agronomy has accepted a position with Brunner Mond and Company where he hopes to have opportunity to carry forward his work with commercial fertilizers. Mr. Shim's work for the college has been greatly appreciated by both students and business interests and the college will make every effort to push forward the work which he has begun.

Mr. C. O. Levine of the Animal Husbandry Department is leaving for the United States about the middle of July. Mr. & Mrs. Levine, and Ruth, are returning to their home in Kansas where interests demand their attention. Their plans for the future are not definite but we hope that the call of this work will prove so strong that they cannot keep away.

Mr. F. A. McClure who has been in the United States for nearly two years is returning to the work, on the Shinyo Maru which leaves San Francisco July 31. Mr. McClure will carry some of the botany courses and help organize the plant progagation work. He will devote at least half of his time to plant explorations which we are carrying out in the province in cooperation with the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture.

REVIEWS

Work in Rural Economics.

The work of Mr. J. L. Buck in rural and farm surveys is attracting considerable attention as heretofore little has been done in this important field. Mr. Buck has published, December, 1923, Volume One, Number Seven of the University of Nanking Agriculture and Forestry Series, "An Economic and Social Survey of 102 Farms" near Wuhu, Anhwei, China. In recent literature we have seen a number of references to this work. Volume Six, Number Twelve of the University of Nanking Bulletins summarizes some of Mr. Buck's findings. In the Wuhu area of central China Mr. Buck has found, with regard to land tenure, that fifty-five per cent of the operators were owners, thirty-two per cent were part owners, and thirteen per cent were tenants. The labor income of the owners was minus $15, of the part owners $156, and of the tenants $105. The net family income of the owners was $120.05, of the part owners, $267.15, and of the tenants $63.46. The average size of the family was 5.4 persons. The owners farmed an average of 20 mow, the part owners an average of 37 mow, and the tenants an average of 15 mow. The average number of separate pieces of land per farm was seven, and the average number of mow per piece was 3.5. The average distance of these pieces of land was one-tenth of a mile, the furthest piece being 2 2/3 miles away. Mr. Buck also has some interesting figures regarding man labor, animal labor, equipment, capital, and character. Mr. Buck has prepared a rural survey blank for use in China.

In May, 1924, there also appeared from Peking a publication of the International Famine Relief Commission, Series B, No. 10, "The Study of Chinese Rural Economy" by C. B. Malone and J. B. Taylor. This was reprinted from The Chinese Social and Political Science Review, October, 1923, to April, 1924. These papers are broad summaries of facts resulting from the surveys undertaken by college students in the summer of 1922, and statistical study of the Committee since that time. The first paper, by Prof. Malone, records the work and experiences of the Tsing Hua survey team in T'ang Hsien, Chihli. The second paper, by Prof. Taylor, is a record of the results of the Famine Commission's investigations, and some most interesting and amazing figures are found in the appendices. Appendix A is a most helpful questionaire on the "Study of the Hsien" (district). It is hoped that these studies can be continued throughout the various sections of China.

Cotton Improvement in China.

Volume One, Number Six of the Agricultural and Forestry Series of the University of Nanking is a most interesting report by Mr. J. B. Griffing of his three years' cotton improvement work, and his observations on the behavior of cotton plants, especially during acclimatization. Mr. Griffing's work is attracting widepread attention throughout China and clearly demonstrates what can be done by concentration. He is working with one of the most important agricultural industries in China's future development, and we hope that before long he will give some attention to cotton culture in South China, in order that we may know more definitely what to expect the cotton plant to do here where heavy summer rains have seemed in preliminary tests to be a handicap.

The College of Agriculture of National Southeastern University is also undertaking to acclimatize American cotton in China, and is working especially with the varieties Trice and Acala. In order to avoid mixing, which ruined so many of the early cotton experiments in China, the work with Acala is carried out at Kiangpu, as also at Shanghai, Wuchang, and Chenchow. Mr. E. L. Sun, Professor of Farm Crops and Cotton Specialist, records in the China Weekly Review, of December 8, 1923, some very enlightening results of his work.

Agricultural and Forestry Notes.

Dean John H. Reisner of the College of Agriculture and Forestry of the University of Nanking is editing, monthly, a series of agricultural and forestry notes which began November, 1923. The last issue, Number 8, appeared in June, 1924. These notes record in a very interesting way the work of the College of Agriculture and Forestry at Nanking and of the Christian rural program now on in China. The Conference of the Committee on Agricultural Education of the China Christian Educational Association have made this paper their official organ.

Chinese Agricultural Papers

Two agricultural papers, in the form of newspapers, are now being issued from Nanking: (1) the Nung Ling Sin Bao (農林新報), published twice each month by the University of Nanking, College of Agriculture and Forestry; and (2) Agricultural Voice (農聲), published three times monthly by the Student Council of the College of Agriculture, Southeastern University. We hope later to develop facilities to keep our readers informed of the contents of these and other papers appearing in Chinese.

Circulars of Agricultural Society of China.

Agricultural students in the United States have organized a society which it is proposed to affiliate with the Agricultural Association of China. In March, and again in May, the officers issued mimeographed circulars, in which they record personal news, and agricultural problems for discussion. In Circular III they published a list of their members, totaling thirty nine names, only four addresses indicating residence in China, all others in the United States. The last circular was issued from 2600 Etna Street, Berkeley, California, which is apparently the address of Mr. F. C. Hsu.

Agricultural Colleges in China.

Growing out of our analysis of Colleges of Agriculture in China, in Volume One, Number Two of this Review, there appeared in the Chinese Economic Monthly, Number Eight, May, 1924, much of this same material, together with supplementary data on the agricultural department of Yenching University. A list of most of the Government agricultural institutions, bureaus, and schools scattered throughout China is also a very acceptable addition. The list, however, does not include organizations devoted to forestation or mulberry tree cultivation. The value of this material is evident, for the whole of it was reprinted in The China Weekly Review of May 24, 1924.

Mr. C. O. Levine had an illustrated article in The China Weekly Review, June 7, 1924, on agricultural education at the Canton Christian College. Unfortunately the title of the article was changed to "Agricultural Education in South China" which was not correct as Mr. Levine wrote only of our own work.

Agricultural Education of Present Day China.

There is increasing interest manifest in China in the subject of agricultural education. We have noted recently a most interesting pamphlet in Chinese from the pen of Dean P. W. Tsou of the College of Agriculture, National Southeastern University. Mr. Tsou divides agricultural education in China into three distinct periods:

(1) The 28th year of Kuang Hsu (1902) to the time of the establishing of the Chinese Republic (1911). During this period most of the provinces developed agricultural schools and experiment stations. But there was little real agricultural knowledge to be found in these centers, as their primary purpose seemed to be to furnish positions to the official class. Therefore Mr. Tsou calls this the period of political agricultural education.

(2) The first year of the Chinese Republic to about the present time. This period has been marked by the organization of agricultural high schools and provincial colleges in considerable number. The heads of these schools were men who had studied their subject thoroughly but who were greatly handicapped by the educational system of the time. These schools did not attempt research, but imported agricultural knowledge and texts from the West and from Japan. Mr. Tsou calls this the textbook period of agricultural education.

(3) The third period was ushered in during the summer of the Eleventh Year of the Republic (1921) when there was held at Tsinanfu a large conference of the agricultural organizations of China, where resolutions were passed regarding China's future agricultural program. Some points emphasized were research and extension work. Each province was urged to reorganize so as to have one central agricultural college, and to proceed with the training of leaders, with experimental and research work, with short courses for farmers, and with rural, social organization that would make possible better living conditions. Since this conference agricultural workers in China have had a desire not only to teach a few students, but also to go out and help the farmers. Teachers, students, and farmers must work together and Mr. Tsou believes we are rapidly coming to the time when this will be true. He therefore calls this the period of farmers' agricultural education.

Mr. Tsou closes his article with a review of the agricultural colleges, especially those organized by government forces. He pays a tribute to the work of western missionary institutions in this important field.

Philippine Agricultural Education.

It is the purpose of the editors of the Lingnaam Agricultural Review to limit the scope of their publication to China. We cannot refrain, however, from pointing to the work of an institution in the Philippines with which we have had a most helpful relationship. We are fully convinced that agricultural institutions in China have much to learn from the experience of the College of Agriculture, University of the Philippines. Dean C. F. Baker, of this college, has recently sent us a fine photograph of their project at Los Banos, showing in a striking manner the twelve year development of this institution from the jungle. This college is one of the greatest and most successful experiments in agricultural education of recent years. At Los Banos there is in the building one of the most solid and permanent foundations for tropical agriculture which has yet been established. It is not only a well known educational center, but in spite of insufficient appropriations for research and experiments it has become a classical station in mycology and entomology, the type locality of several thousand species.

Two recent separates from The Philippine Agriculturist, published by this college, are of striking significance to the poorly financed agricultural institutions of China. The first of these is from Volume Twelve, Number Seven, "The Output of the College of Agriculture" by Dean Baker, a thirty-one page record of the alumni, together with the published contributions from this college. It is Dean Baker's idea that "By their fruits ye shall know them". The second paper, from Volume Twelve, Number Ten, is by Mr. Evett D. Hester. It discusses very fully the "Relation of the College of Agriculture to Lower Schools", and should be read by every agricultural educationalist in China, for scholastic difficulties in the Philippines are not unlike those in China. The College of Agriculture at Los Banos has developed a complete, though somewhat complex, mechanism whereby it may articulate its various curricula with practically every type of secondary school in the Philippine system. The broad entrance policy in the college has been maintained with the constant end in view of popularizing agricultural technical education without lowering the collegiate standards. Upper-end articulation of the college has been maintained by virtue of a supplementary and elastic curriculum.

The Problem of Agricultural Development in China.

In the China Weekly Review, April 12, 1924, Mr. Lawrence Impey, associated in an engineering capacity with the International Famine Relief Commission, had an article on the above subject. After briefly calling attention to agricultural conditions in China commonly recognized, Mr. Impey dwells upon the importance of China's developing a satisfactory policy of agricultural finance. He calls attention to the fact that the Commission has decided to establish a system of Co-operative

Credit on the lines of the Raffeisen Credit Banks of Europe. This will then be followed by a program to instruct the peasantry in the use of modern machinery, methods of fertilization, and rotation of crops. Present conditions along these lines are vividly described from the writer's own observations, and eight illustrations accompany the article.

China Tea.

The leading article in Volume Two, Number Two, of the China Journal of Science and Arts is on the subject "China Tea," in relation to Indian and Ceylon tea. The history of the decline of Foochow and China tea is traced in a most interesting manner. The present situation is indicated by the statement that to-day not more than 30,000,000 pounds of black and 25,000,000 pounds of green tea are exported from China, of which but 7,000,000 pounds of black, and practically no green tea is sent out from Foochow, as against about 550,000,000 pounds from India, Ceylon, Java, and Sumatra. The reason that China has been knocked out of the world market is believed by the writer to be the theory that China tea is not so suited to general consumption as other teas; that China tea lacks what is called "body" in Indian tea, because there is something in the soil of India and Ceylon that is not found in the poor tea soils of China; and that there is lack of honesty on the part of the China growers. The need of law and order in China is emphasized so that something may be done to revive China's tea trade. Eight excellent illustrations accompany the article.

Desert Conditions in North China.

In the China Journal of Science and Arts, Volume Two, Number Three, Mr. Arthur de Carle Sowerby pictures a dismal scene of China, north of the Yangtze. The author claims that *North China is actually being invaded by the desert conditions of Central Asia.* He says, "The terrible desiccation that wiped out the cities of Chinese Turkestan.........is assuredly and inexorably creeping upon North China, and in years to come........ this country will become a howling waste of sand and rugged wind-swept mountains......." Mr. Sowerby believes that the only possible agency that can check the on-coming sand is a damp climate, but to-day signs are not lacking to show that the climatic conditions are growing steadily more adverse. To counteract the invasion of North China by the encroaching Gobi Desert, two possibilities are suggested: (1) a wholesale planting of trees, and (2) careful conservation of all water supplies.

Forestry in China.

Following his discussion in the May issue of the China Journal of Science and Arts, Mr. Arthur de C. Sowerby wrote an article on "Forestry in China" for the July issue, Volume Two, Number Four. Herein it is claimed that the desert conditions described in the first article have been aggravated by the wanton and stupid destruction in North China of the once extensive forests. Mr. Sowerby vividly describes the forested and wooded areas in China north of the Yangtze Basin, and as far south as Fukien in the east, and he claims that unless the Chinese people wake up to the situation, and commence a vigorous policy of forestation, they may expect greater miseries and more abiding poverty in their northern marches than they are subject to even now. Both of Mr. Sowerby's articles have been beautifully illustrated.

The Termites of China.

White ants are ever a serious problem of the builder and planter in southern China. Except for the work of the Japanese in Formosa, heretofore little has been known concerning the species and habits of the termites at work in this part of the world. We therefore welcome from the Laboratory of Zoology, University of Amoy, China, Prof. S. F. Light's papers, "The Termites (White Ants) of China with descriptions of six new species.'' These have appeared in the China Journal of Science and Arts, Volume Two, Numbers One, Two, Three, and Four. These studies are based largely upon material collected by Prof. Light from Amoy and Hainan, by Prof. R. W. Barney, of the University of Hongkong, from Hongkong and the Kowloon mainland, by Mr. A. S. Campbell, of the Canton Christian College, from Cheung Chau Island, Hongkong, and from Canton, and by Mr. A. de C. Sowerby and Prof. C. R. Kellogg from the Foochow region. In addition to very clear descriptions of imago, soldier, and nymphys, when known, Prof. Light discusses the systematic position of each species. He also considers his subject from the economic and biological points of view. In his first paper he publishes a simplified, artificial key to families and genera, based on the characters of winged imago, and to the species, based on soldier characters. Prof. Light records that prior to his work, the known species of termites from China numbered only two. With his six new species we now have a total of eight, as follows:

1. *Kalotermes sinensis* Light sp. nov., from Kwangtung.
2. *Cryptotermes campbelli* Light sp. nov., from Hainan.
3. *Reticulitermes fukienensis* Light sp. nov., near Foochow.
4. *Coptotermes formosanus* Shiraki, from Foochow, Amoy, Hongkong, Kwangtung, and probably throughout South China as far north as the Yangtze.
5. *Macrotermes barneyi* Light sp. nov., from Hongkong, Amoy, and near Foochow.
6. *Termes formosanus* Shiraki, from Foochow, Amoy, Hongkong, Kwangtung, and Hainan, and probably other points to the north and south.
7. *Termes hainanensis* Light sp. nov., from Hainan.
8. *Capritermes sowerbyi* Light sp. nov., from Hainan, Hongkong, and near Foochow.

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CANTON CHRISTIAN COLLEGE
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REPORT OF A FERTILIZER SURVEY IN THE MULBERRY DISTRICTS OF KWANGTUNG

by

Edward Shim, Associate Professor of Agronomy,
Ling Nan Agricultural College, Canton, China.

(Received for publication, June 27, 1924.)

Introduction

The fertilizer survey in the mulberry districts of Shuntak * (順德) and Heungshan (香山) is a supplementary part of the sericulture survey carried out by the Department of Sericulture with funds provided by the Provincial Governor. Inasmuch as the use of fertilizers and manure in the production of mulberry is an agronomic problem, it was deemed advisable that this task should be undertaken by the Department of Agronomy. The author visited Yungk'i (容奇), Kwaichow (桂州), and Taileung (大良) in the Shuntak District (順德縣), covering the period from October 16th to 20th, 1923, and to Siulam (小欖), Kwongyikwai (廣益圍), and Kauchaukei (九州基) in the Heungshan District (香山縣) on May 23rd and 24th, 1924.

This report is not complete for several reasons. It is rather unfortunate that this survey in the Shuntak District was carried out at the time of the year when active rearing of worms and production of mulberry leaves were just over. The last crop of leaves had just been picked. The fertilizer dealers could not and did not expect much business. They were ready for a rest after the rush season of about seven months of work. It was necessary then to investigate by inquiry and not by actually seeing how the manures and fertilizers are used. Inquiring for information in many cases arouses suspicion and the farmers often do not tell the truth. The time allowed for the survey was too short and it was hardly possible to gather much data in this short space of time. More reliable and more detailed information could have been obtained if more time had been allowed and more districts visited. This report will give in a general way the general practices followed on the part of the mulberry growers in the use of fertilizers, chemical as well as others.

The Mulberry District of Shuntak (順德)

The Shuntak District is recognized as the greatest silk-producing district in South China. The three cities visited are important centers around which the silk industry, including mulberry growing, thrives and prospers. Nearly all the commercial or chemical fertilizers sold to

---

* The spelling followed for the Chinese names of places is that adopted by the Ministry of Communications of China as appearing in their Postal Guide. For the names of places without post offices, and therefore not in this Guide, the Eitel-Genahr romanization of Cantonese, in *A Chinese-English Dictionary in the Cantonese Dialect*, is followed, except that two and three character names are joined as in the Postal Guide.

the mulberry grower in this district are sold in the city of Yungk'i (容奇). Filatures are found dotted here and there in Yungk'i, Kwaichow(桂州), and Taileung (大良).

Yungk'i and Kwaichow are twin cities or villages, separated politically and geographically by a canal. Taileung is another city nearby, just across a range of hills. The cities are situated on a tributary of the West River, and each can be reached from the other by water. Commercial village junks and silk boats ply between Canton (廣州), and these cities daily. It requires about six hours from Canton to Yungk'i, depending on the tide.

The West River (西江) with her muddy water meanders through fertile plains of mulberry fields. Even the higher lands are covered with mulberry. It is the one crop indispensable to the silk industry.

Commercial boats ply between Hongkong (香港), Canton (廣州), and other inland cities and the three cities mentioned, especially Yungk'i. The river with her tributaries and canals affords cheap and easy transportation facilities. The fertilizer may be shipped to Yungk'i from Canton or from Hongkong by water. Farmers can buy it in Yungk'i and transport it home to the mulberry field by small boat.

According to General Chau Chi Jing (周之貞), Magistrate of the District, on whom the author had the pleasure of calling, the silk industry means to the Shuntak District an annual business of about 70,000,000 dollars, Kwangtung silver.

Fertilizers and Manures used on Mulberry

The fertilizers and manures used on mulberry are as follows: (1) night soil or human excrement; (2) peanut cake; (3) bean cake or soybean cake; (4) animal excrement; (5) pond mud and canal mud; (6) soil from old walls; (7) sericulture waste; (8) sweepings or lap sap (垃圾); (9) feathers; (10) chemical fertilizers.

Night Soil

A time-honored fertilizer, religiously conserved and economically used by Chinese farmers, is night soil (human excrement). It comes in both the solid and in the liquid forms. Like farmyard manure, which includes the litter or straw, the night soil as used for application likewise includes paper. This fertilizer has not by any means been relegated to the background by the introduction of foreign chemical fertilizers.

Public toilets are scattered here and there in these three cities visited in Shuntak (順德). In Yungk'i (容奇) the most "popular" one is located almost in the very heart of that city, next the main street.

Some of the toilets have more or less of concrete construction, others are made all of wood. Some are located above fish ponds, others on road-sides, still others in different parts of the city. Large earthenware receptacles are found more commonly for the liquid night soil. Thus as much of this human excrement as possible is saved through these various conveniences provided.

In some types, particularly those located above fish ponds, the droppings are collected on several wooden planks nailed together, located directly under the squatting bench. Occasionally the collector visits the toilets and carefully loads and transports the night soil to the farm. In some of the "water closets" located on fish ponds, the droppings are not collected and used as fertilizer but used as food for the fish. In some toilets the liquid portion is mostly lost. When the night soil is not used at once it is sold and dumped into large cement receptacles to undergo fuller decomposition, and later resold to the farmer. This pond or receptacle has two compartments, each about 20 ft. long, 15 ft wide, and 3 ft. deep, and covered with a shed or roof. It is thus stored for about a year, and then sold out at about one dollar for 300 or 500 catties. There are a few of these ponds in Kwaichow (桂州).

Not only is the local night soil used but also not a little is bought and brought in from Hongkong. There is one company in Hongkong to which is given the sole right to collect all the night soil in Hongkong and in all the suburbs upon the payment of a sum of several "ten thousand" dollars to the Hongkong Government annually. From Hongkong much of this is shipped to Wonglin (黃連), a village in Shuntak (順德), for distribution. As to just how much of it is sold to the mulberry grower no one was able to give any reliable figure. The price varies greatly, around 70 catties for a dollar. Solid human excrement, free from urine and water, is sold at 60 catties for a dollar. Unadulterated urine sells at about 40 cents for 100 catties.

The night soil is first diluted before it is applied to the mulberry. It is used by some farmers when the mulberry stocks are cut down to within about one foot of the soil and forced to send out new shoots to provide leaves for the eight and ninth crops of worms.

From average figures from Japanese and European analyses, night soil contains the three important fertilizing elements in the following proportion: nitrogen (N) 0.63 per cent; phosphoric acid (P_2O_5) 0.20 per cent; and potash K_2O) 0.24 per cent. It may be of interest to note here that the annual production per capita is a little over 1000 pounds (1073.3 pounds), based on European figures. These figures are taken from Reisner's article, "Modern Commercial Fertilizers in China", which appeared in the May 7, 1921, issue of "The American Fertilizer."

The night soil in the city of Canton is shipped to the farms, and not a little is sent to this district.

Peanut Cake

Peanut cake is a valuable by-product in the manufacture of peanut oil. It is used as a fertilizer as well as stock feed. It is sold on the market as a cake, hard and dried, after the oil has been extracted. Analysis from the Kwangtung Agricultural Experiment Station shows that it contains 7.814 per cent of nitrogen, 1.349 per cent of phosphoric acid, and 7.856 per cent of potash, and 75.379 per cent of organic matter.

It is quite commonly used by the mulberry grower. When asked as to how much of this cake is used on mulberry, a dealer said "several tens of ten thousand dollars" worth, meaning several hundred thousand dollars a year. Most of it comes from Canton (廣州) and from Ch'ants'un (陳村), a neighboring village famed for the manufacturing of peanut oil. The price ranges from $4.50 to $9.00 per picul (133 1/3 lbs.)

In addition to the local grown peanuts most of the imported peanuts are also used in the manufacture of oil and cake, a considerable percentage of which is used on the mulberry fields. The Chinese Maritime Customs' figures for 1923 show that 1,821,052 piculs of groundnuts in kernels (peanuts) valued at 13,293,679 Haikwan taels, and 223,972 piculs of peanut oil valued at 3,135,598 Haikwan taels have been imported into Canton alone. The cake is not handled by only one company, but by many small dealers. The Un Tsu (源聚) Peanut Cake Co., one of the largest dealers, sells exclusively peanut cake, and their annual sale, according to estimation, is about 130,000 catties (one catty is equivalent to 1 1/3 lbs.). The price for one picul varies with the market conditions. At this time this company quoted the price of $7.50, Kwangtung silver, for one picul. All the cake handled by this dealer comes from Canton and all sold to mulberry growers. When asked as to how it is applied on mulberry, the dealer gave this information, "One taam or one picul of the cake is soaked in two piculs of water for about two weeks, after which it is diluted and applied to the mulberry". Another cake dealer gave this information, "One picul of the cake is powdered and mixed with four catties of "tea cake", *Ch'a fu* (茶麩), and all soaked in water for a little over 10 days until well dissolved. At the end of this period the dissolved material is diluted at the ratio of 4 catties to 40 catties of water and applied to the mulberry with a large wooden dipper". The tea cake is added, it is claimed, for the purpose of offsetting the fragrant odor which attracts insects to the peanut cake. It acts as a repellant. The tea cake is from the plant, *Thea oleosa* Lour. Oil is extracted from the fruit of the plant and used as hair oil, while the cake is generally used for washing hair. It has the following composition: nitrogen, 1.642 per cent; phosphoric acid, 0.305 per cent; potash, 0.385 per cent; and organic matter, 81.174 per cent. These figures are taken from the average of three analyses from the Fifth Chemical Report of the Kwangtung Agricultural Experiment Station.

Bean Cake or Soybean Cake

Bean cake is a by-product in the extraction of oil from the soybean. The cake is hard, like the peanut cake.

The chemical composition of soy bean cake is 6.62 per cent nitrogen, 2.20 per cent phosphoric acid, and 1.80 per cent potash. The figures are taken from Reisner's article, "Modern Commercial Fertilizers in China", which appeared in the May 7, 1921, issue of "The American Fertilizer".

The cake when used as a fertilizer is treated in much the same way as the peanut cake. Like the peanut cake it is also used as stock feed. It is not so popular with the mulberry grower as the peanut cake, so the quantity used is less.

The Fifth Chemical Report of the Kwangtung Agricultural Experiment Station gives the average of three analyses as follows: nitrogen, 6.449 per cent; phosphoric acid, 1.91 per cent; potash, 1.462 per cent and organic matter, 74.464 per cent.

Animal Manures

Most of the animal manures used for mulberry are from the hog, and occasionally from the cow and the horse. Nearly every family raises a few pigs. Naturally one expects this to be a source of manure. It differs from barnyard manure used in Western countries in that it does not include straw or litter.

Those peddlers or dealers who buy night soil and store it in ponds, as mentioned elsewhere, also buy animal manures. Instead of putting these into the pond as is done with the night soil, the animal manures are first spread out on a hard clay floor to be dried, after which they are piled in a large heap ready for sale. Several of these heaps are found in Kwaichow (桂州).

This sort of manure is used by being first diluted with water and then applied to the mulberry with a dipper or sprayed onto the base of the plants.

Pond Mud and Canal Mud

Pond mud and canal mud are made up of fine sediment of the soil particles deposited in ponds, in rivers, or in canals. The canal system in the delta region of this province furnishes abundant supply of this fine deposited soil material which has a commercial value in Chinese agriculture. This product comes into the market in the form of slabs resembling baked mud or clay. It is not considered a fertilizer. As a soil it is comparatively rich and this combined with its mechanical texture and the open nature when the material is broken up into small pieces make it valuable, especially for horticultural work.

The following analyses may be of interest:

Mechanical analysis

	per cent
Fine gravel	nil
Coarse sand	1.1
Fine sand	17.2
Silt	22.3
Fine silt	23.9
Clay	11.9
Loss on ignition	12.4
Moisture	4.3

Chemical analysis

(Calculated on dry material)

	per cent
Nitrogen (total)	0.44
Nitrogen (nitric)	nil
Phosphoric acid (P_2O_5)	1.16
Potash (K_2O)	0.76

The mechanical and chemical analyses are taken from the September number of the Malayan Agricultural Journal, Vol. X, No. 9, from an article by B. J. Eaton and C. D. V. Georgi.

The Fifth Chemical Report of the Kwangtung Agricultural Experiment Station gives the following composition for canal mud and for pond mud:

	Canal mud per cent	**Pond mud** per cent
Nitrogen	0.231	0.310
Phosphoric acid	0.193	0.323
Potash	0.284	0.401
Organic matter	6.443	9.413
Moisture	7.254	8.141

The mulberry plant is cut flush with the ground about two weeks before Christmas, the water in the canal drained, and that in the fish pond pumped out before the mud is plastered onto the mulberry fields for the winter.

Pond mud is extensively used by growers whose mulberry fields are located close to canals and rivers and fish ponds. The mulberry fields along the rivers and canals are combed at regular intervals by artificial canals which allow the water to flow into the latter at high tide and leave fine sediment in them at low tide. Regular variation in tide movement causes deposition and accumulation of this mud. Some of these artificial canals have a water gate by which tide water can be locked. Then this water is used for irrigation.

Pond mud is not used by all mulberry growers. Those whose fields are higher and above the reach of water do not use it.

About 40 per cent of the area of the mulberry district is fish pond and canal, mostly the former, and about 60 per cent is in mulberry. Consequently in the greater part of the mulberry district the mud for fertilizing comes from fish ponds.

Soil from Old Walls

It is of interest to those who are not so well acquainted with Chinese agriculture to know the value of this material as a "fertilizer" and the high esteem in which it is held by the Chinese farmers.

Centuries ago Chinese masons used to build houses from clay soil taken from the mountain, soil fine and plastic enough to be capable of being molded into slabs. Some of these dwellings are still standing, although dilapidated. Upon long standing through the ages it is said to have absorbed some nitrogen. The Chinese call the material of value contained therein *hsiao huang (siu wong--硝黃);* strictly translated, this means nitrate and yellow or sulphur. A sample was brought to the College and analyzed. In the chemistry laboratory it was found to contain sodium nitrate.

This material is prized not only as a "fertilizer" but also for the making of explosives.

The *hsiao huang* *(*siu wong*--硝黃) is found more abundantly on walls of public toilets. It is said that the lower part of the wall contains more nitrate than the upper portion and that the amount varies inversely with the height of the wall and directly with age. The wall should stand at least 10 years before there is any appreciable quantity of nitrate.

Brick wall, no matter how long it is subjected to weathering, cannot absorb any nitrate as this material does. The difference between brick and this wall material is that the former is burned in its manufacturing process while the latter is not. It seems then that burning destroys the absorptive property. It is claimed that when the wall is replaced by brick on an exchange basis the brick man has to pay for the privilege of making the exchange.

This old wall soil is used to a very limited extent because of its scarcity. The nursery man in Yungk'i (容奇) believes, from practical experience, that it is even better than chemical fertilizer. Before applying it to the crop, it is crushed, ground, and sieved. The author believes that this subject requires further study.

Sericulture Waste

With the feeding of mulberry leaves to silk worms there are always left behind coarser parts of the leaves which are not eaten. This together with the droppings of the worms and with some dead and probably diseased worms forms a waste which is called "sericulture waste". It is the general belief among farmers that it is a good fertilizer for mulberry. It is the belief, although not a proved fact, that, when the waste containing pathogenic organisms is applied to the mulberry, there is a possibility of these organisms coming to the next crop of worms on the leaves from the plants fertilized with this waste. The ordinary farmer does not realize this. The author believes that it is a good fertilizer for lowland rice. It undergoes rapid decomposition when left in the open and acted on by the weather, thus changing into organic matter of an available form in a comparatively short time. The waste from the Department of Sericulture of this College is all sold and used as a fertilizer but never on the College mulberry fields.

Sweepings or La sa (垃圾)**

Sweepings or *la sa* (*lap sap*--垃圾) consists of all wastes from the farm, the household, the street, the factory, from anywhere and from everywhere. It is far from being homogeneous in composition. It consists of paper, dirt, tin cans, leather, feathers, manure, hair, cloth, fire-cracker paper, general rubbish, garbage, etc. etc.

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*The romanization of all common names is given in both Mandarin and Cantonese. The Giles spelling found in *A Chinese English Dictionary* is given first, followed by the Eitel-Genahr Cantonese and the Chinese characters in parenthesis.

**The characters used by Eitel-Genahr for *lap sap* are made up of 18 and 16 strokes respectively. Not having in stock the more complicated forms, the printer has used the simpler characters commonly accepted in ordinary writing.

This material is gathered locally, and it is considered a nuisance to have it around. The owner is glad to dispose of it at ten cents a picul. Sometimes it is difficult to get rid of it even at this price.

In Canton all the sweepings are collected by one company and shipped to Hato (下渡), a village east of this College. From here it is sold to those who want to buy. About the middle of February this year the author saw over ten junk loads of the sweepings going from Hato to Shuntak (順德) for the mulberry fields. Each load is said to cost from thirty to forty dollars. The Department of Sericulture of the College, applies this material as a top dressing on the mulberry after the last picking in winter. It costs about ten cents per taam (Chinese load) of 40 to 50 catties. The mulberry farmer realizes the fact that sweepings are not a quick acting fertilizer like ammonium sulphate He believes that it does keep the weeds down, that its fertilizing effect is more lasting than that of other fertilizers, and that it has a loosening effect on the soil. When used it is generally applied in the winter after the last picking of leaves.

Feathers

Feathers are used but not generally.

CHEMICAL FERTILIZERS

History of the use of Chemical Fertilizers

The use of chemical fertilizers began one or two years before the Republic, about 1910, when the Tai Shang Co. (大生) of Canton, which represents the Mitsui Bussan Kaisha, started to sell sulphate of ammonia to the mulberry grower. The sulphate was of dark brown color. The farmers did not readily accept it at first, but when it was found by actual application that it increased the yield they regarded it with a little more favor.

Another company that began at about the same time as the Tai Shang Co. is the Chik Hing (植興), who acted as the agents for the Carlowitz Co., a German firm. The name of Chik Hing was later changed to Li Hing (利興). These two firms were about the only ones to sell chemical fertilizers to mulberry growers for about ten years.

The sale and use of fertilizers were slow at the beginning. Gradually they increased until two or three years ago the business was so flourishing that the number of firms engaged in this line of business was incredibly large. In 1921 there were only two or three fertilizer stores in Yungk'i (容奇). In 1922 there were about ten. In 1923 there were sixty-eight stores, firms, agencies, and individuals who dealt in chemical fertilizers. It was certainly an attractive business, but, as a matter of fact, too attractive to be profitable. Naturally competition was strong, adulteration practiced in a very few cases and, speaking of the business as a whole, it was not profitable in the latter half of 1923. The heavy rains with subsequent flooding and the typhoons caused some damage to the mulberry crop during the latter half of the production period in 1923. The sale was correspondingly decreased.

No one seemed to be able to give any reliable information on the amount of chemical fertilizers sold annually in the Shuntak District (順德縣). Some estimated the sale at 250,000 dollars while others would place the figure at 300,000 dollars, Kwangtung silver. This difference is not hard to explain. One man knows how much he has sold or how much his agents have disposed of. But to know how much others—and there are 68 altogether—have sold, there is no man in position to give even an approximate figure. This sum, whichever one is correct or nearer to being correct, represents the annual sale of chemical fertilizers, principally ammonium sulphate, all imported from foreign countries. The amount of Chilean nitrate sold for mulberry is very small.

Sulphate of Ammonia

Sulphate of ammonia is the principal chemical fertilizer sold on the market. This product has several colors and forms. There are the white, the grey, the brown, and the dark brown or almost black. The different forms are fine crystalline and coarse crystalline. Then, too, there is the difference in the smell or odor. But the greatest favorite is the brown, coarse, crystalline. The Chinese call the brown sulphate *hsia tan (ha tan* 蝦蛋*)* meaning shrimp-egg, the brown, coarse, crystalline, *ts'u chen (ts'o cham* 粗針*)*, meaning coarse needle, and the fine, brown, crystalline, *yu chen (yau cham* 幼針*)* meaning fine needle. The brown sulphate is sold as high as twenty dollars per picul (133 1/3 lbs.) while white sulphate was only about thirteen dollars at Yungk'i (容奇) at that time. Yet the former is much preferred. No one interviewed, whether farmer, dealer, or chemist, was able to give the reason why the Chinese farmer in this district, who buys any sulphate of ammonia at all, would prefer the brown, coarse, crystalline form even at such a high price. Would it be that the fact that the first sulphate used was of that form is a sufficient reason for the preference? That may be a sound psychological reason, but not sufficient. It may be of interest to mention here the fact that owing to the difference in color a case is now before the Chinese court. A Chinese dealer, in an agreement with a foreign firm, promised to take over a certain consignment of fertilizer upon arrival, regardless of color. When the shipment arrived the Chinese refused to take over and to pay for the consignment on the ground that it was of a different color from what he expected.

Twelve samples of sulphate from Yungki (容奇) imported from different foreign countries were brought to the College for study. Eight are reported as coming from Japan, one from Germany, and one each from America and England. Of the Japanese, three are brown, coarse, crystalline, which were sold at $20.00, local silver, per picul, three are brown, fine, crystalline, which were sold at $20.00, l.s., per picul, and two dark brown, or black, crystalline, which were sold at from $16.00 to $20.00, l.s., per picul. The American sulphate is almost white and sold at $13.00, l.s. The English sulphate sold around $14.00. The German yellowish white sold at $16.50. Thus one can readily see the high price that the darker colored sulphate commands, which is said to have come from Japan. The white product which is claimed by an American dealer to be purer than the colored was selling at the lowest figure and with little demand.

In commercial forms, sulphate of ammonia contains about 20 per cent of nitrogen. It is also pointed out by another dealer that the colored sulphate contains sulpho-cyanide and other cyanogen compounds which are of no benefit to the crop. Even in spite of these contentions the farmers in this district prefer the colored ones. Realizing the preference that farmers hold for the color, several fertilizer dealers are adding coloring material to the lighter or white sulphate to attract buyers.

Why has chemical fertilizer and almost exclusively ammonium sulphate come into use so extensively in the last few years by the mulberry grower? Mulberry leaves are much in demand during the busy season from March to October. It is then the purpose of the mulberry producer to get as many leaves as possible in the shortest possible time. Chemical fertilizer is soluble in water, easily undergoes nitrification, and becomes quickly available to the plant. The native fertilizers, as night soil and cake meal, are much slower in solubility and availability and hence do not produce striking growth in the vegetative portion of the mulberry as the chemical fertilizers do. Furthermore they are much lower in nitrogen content. The dealer claims that there is a perceptible difference in the growth of the plant even three days after application, and this fact is substantiated by the farmer. There are about seven crops or pickings of mulberry leaves in a year, which really cover a period of about seven months. There is therefore an average of about one picking in a month. It takes chemical fertilizer to bring about a quick and high yield.

In using the fertilizer the ammonium sulphate is diluted at the rate of one catty to one hundred and fifty catties of water, or one part to one hundred and fifty parts of water. After dilution it is poured on or sprayed onto the plants. If it is raining or if it is about to rain, it may be applied in the dry form, the rain dissolving and diluting it.

One mulberry nursery man indicated that he prefers the white ammonium sulphate over the colored product for his seedings and claimed that is not so "strong" as the "shrimp egg color" fertilizer.

Some farmers recognize that continual application of sulphate alone causes hardening of and acidity in the soil, although such conditions have not assumed so great proportions as to cause general alarm.

Chile Saltpeter

Another chemical fertilizer used is Chile saltpeter, but the amount used is very much smaller that that of sulphate of ammonia. This fertilizer is not popular with the Chinese farmers. It is too hygroscopic. This property is well manifested when it is handled and exposed to the humid atmosphere which characterizes the summer weather. And it is during the summer that it is used. One man remarked that, after he bought a bag of Chile saltpeter, a part of it was changed into liquid. It is sold at about the same price as the lighter colored sulphate and a little cheaper than the colored ammonium sulphate. The price was about $13.50, l. s., per picul. It contains about 15 per cent of nitrogen and the nitrogen is in the most available form for the plant.

The Chilean nitrate, like the saltpeter, KNO_3, is subject to taxation by the Government. The tax for the former is one dollar per picul. Formerly the power to collect the tax was granted to a bureau which had the monopoly on the potassium nitrate and the sulphur. But now any one can sell Chilean nitrate provided he pays the tax of one dollar for a picul to the Government. The deliquescent nature of the nitrate and the one dollar tax discourage dealers from handling this product.

The Chilean nitrate is applied in much the same way as the ammonium sulphate.

In Heungshan District

On Friday morning, May 23, 1924, the author visited Siulam (小欖) in the Heungshan District (香山縣). The city of Siulam is about two hours beyond Yungk'i (容奇) by village boat.

The whole country surrounding this city is a mulberry district, of which it is the business center. Kwongyikwai (廣益圍) and Kauchauki (九州基), situated one on each side of the West River, were visited in this investigation. Everywhere as far as the eye can see mulberry abounds. The muddy West River winds through this beautiful country, green with mulberry plants. The monotony of this scene is broken in the distance by faintly-outlined chains of mountains.

The city of Siulam and its immediate vicinity have a population of about 160,000.

In Kwongyikwai

The mulberry country of Kwongyikwai (廣益圍) was visited on the afternoon of May 23, 1924.

According to several growers, who are elders of a local church, about half of the fertilizers used consists of night soil. Next comes pig manure and then peanut cake. Chemical fertilizer is not popular here and is used to a very limited extent, because they claim that it hardens the soil and produces leaves of poor quality. Night soil is valued at one dollar per *kang* (*kong*- -缸) (earthenware jar) of about 80 catties. It consists of both solid and liquid excreta and it is not unusual to find water added to it. After the home supply is exhausted, what more is needed for the mulberry is bought in Siulam (小欖).

In using, one jar is diluted to three jars with water before it is applied. It is then carried to the field. Very shallow holes are dug at regular intervals between the rows and into these holes the night soil is poured with a dipper. The latter has a long handle, so that it can dip into the boat which carries the night soil and have a long reach for the application.

The pig manure used is produced on the farm. Generally every grower has a few pigs and they give not a small amount of manure for each small farm. It is applied in much the same way as the night soil. Sometimes it is not put into holes but applied directly to the base of the plant. Very little of this is bought as compared with the human excrement. Sometimes the pig manure is mixed with the night soil.

Peanut cake is bought from the oil factories in Siulam (小欖), or from stores in Siulam which buy it from Chantsun (陳村) and from Canton. It was valued at $7.00 per picul of 133 1/3 lbs. The cake is dissolved with two to three piculs of water for over ten days until it smells "bad" before it is used on the land. This is claimed to be better than either the night soil or the pig manure.

In Kauchauki

The region of Kauchauki (九州基) was visited on Saturday, May 24, 1924. Several farmers were questioned and several farms visited in this investigation.

Here one earthenware jar *kong* (*kong* 缸) of night soil weighing 120 catties is worth about $.60, l. s. It is usual to apply 7 or 8 jars to one *mou* (*mau*--畝) of land. (4.84 Cantonese mow are equivalent to one English acre.) The night soil must be diluted, as is the general practice, before it is applied to the base of the mulberry plant or poured into holes as mentioned elsewhere. The latter practice is used during very rainy weather to prevent washing.

Ammonium sulphate is better liked here than in Kwongyikwai (廣益圍). The coarse, brown, crystalline sulphate sells at $20.00 to $21.00, l. s., per picul, about 5 catties for one dollar. The white sulphate is cheaper, 6 catties for a dollar. As is the general opinion in every section visited, the farmers here believe that coarse, brown, crystalline sulphate is better than the white. The amount used varies from 4 to 20 catties per mow. The rows are about 2 feet apart. It is claimed that the sulphate is more effective during rainy weather. When the fertilizer is applied during dry weather it is usual to dissolve the material before using, or water is applied to the fertilizer already added in the dry form. The sulphate is bought in Siulam (小欖) and then transported home on boats or on the shoulder. There were over 40 dealers in Siulam last year, but this year there are only about ten. This is caused chiefly by a general and sudden depression of the sericulture industry.

Pig manure is also used either alone or in mixture with night soil. The author saw two farmers applying this. One was loosening the soil around the plants while the other used a long handled dipper to apply the manure from a boat to the field. It costs about 10 cents for an earthenware jar (缸).

Here peanut cake is sold at $6.20 a picul. It is usual to use 30 catties of the cake to a mow. One application is generally good enough for two crops. The cake is prepared and applied in the usual way.

Sericulture waste is used both here and in Kwongyikwai ([illegible]益圍), but there is not enough produced on each farm to apply to all the mulberry. It is used at a rate varying around 4 piculs per mow. It is valued at about $1.00 per picul.

Canal mud and pond mud are used by every farmer both here and in Kwongyikwai. The mulberry fields are not one continuous and unbroken piece of land. The crop is grown in beds each separated from the other by a pond or canal. The soil excavated in the making of the canal or pond is thrown up on the beds. It is possible for the tide water to reach into the canals for miles around. The fish ponds are filled with rain water, which is abundant during the spring and summer. When the muddy water is left undisturbed sedimentation or silting takes place, allowing the finer grades of the soil particles to settle to the bottom. This deposit together with whatever is in the pond or canal makes up what is called pond mud or canal mud. The mud is plastered over the field between the mulberry plants during December. Since every field or bed is bordered by a canal or a pond the application of mud becomes a general practice.

Sweepings or *la sa* (*lap sap-* -垃圾) is little used here.

APPLICATION OF FERTILIZERS AND MANURES

In the Mulberry Districts

The kind and amount of fertilizers and manures used on mulberry vary so much that there is nothing general in its application. Some farmers use commercial fertilizer alone, others use two or more kinds. The kind and quantity vary with many factors, such as market conditions, soil, climate, condition of crop, availability of manure, etc.

Perhaps the following practices or applications used by a few farmers would give some idea:

1. One farmer used 6 catties of ammonium sulphate and 13 catties of peanut cake per mow, applied after every picking of the leaves.

2. Another farmer used 6 catties of ammonium sulphate and 2 piculs of night soil per mow after every picking.

3. Another applied 5 catties of ammonium sulphate alone per mow after every picking.

4. Another used over 10 piculs of liquid night soil per mow, 4 times a year.

5. Another used 200 catties of night soil and about 5 catties of ammonium sulphate, 3 times a year, area applied not mentioned.

6. Another used 4 catties of ammonium sulphate and 30 catties of peanut cake per mow after every picking.

7. Another used 50 catties of peanut cake and 25 catties of ammonium sulphate in January, April, and July, area applied not mentioned.

8. Another applied 5 catties of ammonium sulphate and 7 catties of peanut cake per mow, after every picking.

9. Another used 40 catties of peanut cake per mow, once for every two pickings.

There is no comparative record taken from actual readings for the effect of different kinds of fertilizers and manures on mulberry beyond the fact that application increases yield over no application.

Fertilizers and Manures used in other Districts

Reports from other mulberry districts not visited by the author indicate that ammonium sulphate is used almost exclusively by mulberry growers in Chiulin (朝連), Hotong (荷塘), and Pakkai (北街), all in Sunwui District (新會縣). Farmers here like the sulphate because it is considered as good as, if not better than, native manures and because the crop responds to its application more quickly than to that of native manures. Commercial fertilizers are also very popular in the Tungkun District (東莞縣).

Hookworm and the use of Night Soil

It was fortunate that, in the investigation in the Heungshan District (香山縣), the author went in company with Dr. Frank Oldt of the Canton Hospital, who is at present working on the hookworm problem.

In Kauchowki (九州基) an old farmer, half diseased with trachoma and hookworm of a very serious nature, ran for half a mile to see Dr. Oldt, when we were on our way homeward to Siulam (小欖). Others in both Kauchowki and Kwongyikwai (廣益圍) wished to know if they were free from hookworm or if their stools were positive in the microscopic examination.

In taking soil samples from the mulberry fields care was taken to scrape off the surface layer of the soil to which night soil has been applied. The latter was from people who are known to have the hookworm disease. Three to five samples were taken from each farm.

Out of the 16 farms in Kwongyikwai (廣圍益) 6 samples from one farm with a definite history of application of a week before show the presence of larva as follows: can no. 10—150; can no. 11—32; can no. 12—241; can no. 13—138; can no. 14—195; can no. 15—341. The remainder were slightly infected or negative.

Soil samples in Kauchowki (九州基) show a few hookworm larvae, but the stool examinations show that there is sufficient hookworm disease to constitute a serious health problem.

The subject of hookworm disease in its relationship to agricultural practice may be found in an article which appeared in the Canton Gazette on April 10, 1924, under the title of "Use of Night Soil and Sanitary Crop Production". The cycle of hookworm infection or epidemiology may be better understood by quoting a portion of this article. "The worms do not multiply in the human body, but produce eggs which escape with the bowel movement. When these eggs fall on moist soil they hatch and produce microscopical larval worms, which enter the human body usually through the feet or hands, make their way to the intestine by way of the blood system and lungs, and then grow to maturity in about a month. Since the human hookworm can only develop in man it is spread from contact with places where human feces have been placed on the soil. If, for example, the night soil containing living hookworm eggs is placed on a field of vegetables, which is kept constantly moist either by irrigation or rain, the eggs will hatch minute infective larvae, waiting for contact with the feet or hands of the laborer."

While night soil is considered a good fertilizer it is not absolutely safe to use because of the possible hookworm infection. The heavy rainfall during the mulberry season and the general practice in intensive cultivation by farmers who invariably work without shoes offer admirable conditions for hookworm infection.

With a population of 160,000, each individual producing 1073.3 pounds of night soil per year, and with its use as a fertilizer so general, we can realize the immensity of this problem of hookworm disease as associated with the use of night soil.

The author is carrying on experiments to test the manurial value of night soil heavily infected with hookworm, by applying it to crops. Storing such night soil over a certain period, according to parasitologists, is said to eliminate all possible hookworm infection and render it safe for application. The object is to determine from field experiment the fertilizing value of the night soil at this stage when it is safe and free from infection as compared with others stored at different periods.

Conclusion

The clean and careful cultivation of the mulberry field and the economical habit of the farmer in the use of anything that has manurial value are desirable and commendable practices. The use of chemical fertilizer, especially ammonium sulphate, demands judicious application. It has been proved that the use of sulphate of ammonia results in an increased yield. It is not the point of an increased yield so much as the most economical amount to use that should be considered by the farmer. Some farmers realize the undesirable residual effect ammonium sulphate has on the soil if applied on the land continuously for a number of years. They do not know that addition of lime would not only correct the acidity of the soil but also supply it with lime which is exhausted by the sulphate. Lime also encourages bacterial action which is necessary for the processes of ammonification and nitrification. The beneficial effect of lime on the physical condition of the soil also encourages its use. If must be remembered that lime should never be applied together or mixed with sulphate of ammonia. The "Calbux" lime is eminently suitable for this purpose. For the prevention of hardening of the soil steamed bone flour may be used. The flour may be bought on the market.

Some farmers believe that the application of ammonium sulphate produces an inferior quality of leaves. While this point is reported from practical experience by farmers, it needs to be substantiated by actual experiment and careful study. Farmers generally arrive at conclusions too hastily from insufficient evidence.

Since the fertilizers and manures used, as mentioned above, contain relatively far more nitrogen than other ingredients, it seems that there is need of phosphoric acid and potash in the mulberry soil.

The author believes that the fertilization of mulberry fields should be done on a more scientific basis. There should be actual fertilizer experiments carried out in the midst of the district to demonstrate the value and the economical application of fertilizers and manures to mulberry and the quality of the leaf as influenced by them.

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NIGHT SOIL STORAGE IN RELATION TO HOOKWORM VIABILITY

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There is little or no accurate data as to what significance the use of night soil as fertilizer in China has in the spread of intestinal diseases, such as cholera, dysentery, and typhoid. It is certain that contamination of food or drink by human dejecta is the way that these diseases are carried. The use of night soil on crops may be a factor of vital importance or may be negligible. It is certainly a factor in the spread of hookworm. A method of treatment that would prevent night soil from spreading hookworm would in all probability also be effective in preventing other intestinal diseases, thus making fundamental the study of hookworm viability in night soil. It is a question of no small importance to all interested in agriculture. The question of fertilizers for crops is a big one, and night soil is too valuable not to be considered.

The use of commercial fertilizers has grown to large proportions in South China. It is not displacing but is only making up for the insufficient supply of night soil. It has not proved altogether satisfactory. Farmers who use it say that while results are immediate and good, it leaves the soil in a hard, unworkable condition. It does not supply the organic matter necessary to keep the soil workable. There is little hope that an adequate substitute for night soil can be found for use in China. The problem is to make night soil safe for use by the farmers, and if possible make it more efficient by special treatment. The willingness of the farmers to use commercial fertilizers augurs well for the possibility of introducing a safe method of using night soil, if only it is more efficient as a fertililizer, and practicable of application under the special treatment.

To find a method whereby night soil can be improved or have its maximum efficiency, and still not be a medium for the transmission of hookworm disease, is the purpose of the investigations started about two years ago by the Ling Nan Agricultural College at Canton Christian College, in connection with the Canton Hospital Health Service. To ascertain the time hookworm eggs remain viable in Chinese storage jars, and the relative fertilizing value of night soil stored for different periods of time, under various natural conditions; to work out details of the mechanism of infection by hookworm under local conditions; to work out the various epidemiological factors in this part of the world: would form a sound basis for planning a hookworm eradication program, both in treatment campaigns and prevention of reinfection. This paper is a brief preliminary report and records some of the findings of work done in the years

1922 and 1923. Some of it corroborates work done elsewhere. It also gives us some light, we hope, on how to attack the hookworm problem in South China, and indicates along what lines to make further studies.

Glass Jar Experiments

In order to test the viability of hookworm eggs in feces diluted with water, on August 15, 1922, approximately 100 grams of the stool of a Canton Hospital patient were put in a glass jar and diluted with water, so as to imitate as closely as possible natural conditions of night soil storage. This contained very many eggs, in all stages of development, from two-celled to active worms ready to hatch. In fact some were observed to hatch. The glass jar was put into a flower pot in which moist, sterile earth was placed. This jar, labelled *Jar No. 1*, was examined at times indicated in Table No. 1.

On August 30, 1922, a sample was set up in *Jar No. 2* in a way similar to *Jar No. 1*. This sample was taken from a night soil storage jar which on examination, August 26th, had hookworm eggs in all stages of development. On August 30th, examination showed eggs largely in the morula and gastrula stages. On August 31st more material from the same source was added. This jar was examined at times, and with findings as indicated in Table No. 1. Salt flotation was the method used for examinations. No attempt was made to determine quantitative results.

On September 3rd dirt was removed from under *Jar No. 1* and put through Baermann apparatus to isolate any larvae, and new, sterile, moist earth was put in its place. On examination September 4th the dirt was found to be absolutely negative. On September 6th and 7th this was done for *Jar No. 2* with negative results. It was repeated for both jars on September 10th and 11th with negative results.

The findings of these experiments were:

(1) Eggs that had already developed to worm in eggs soon disappeared; those in *Jar No. 1* between August 15th and 17th; and in *Jar No. 2* between August 26th and 30th. Both of these jars, at the beginning, had very numerous, actively developing eggs, in all stages of development including living worms ready to hatch, some of which we watched leaving their shells. After being diluted with water, no eggs containing worms were observed. The nearest to this was *Jar No. 2*, on September 3rd-6th, when some eggs, almost changed to worms, were observed. They did not leave the jar, as negative examinations of sterile earth around base of jars preclude this possibility. They either did not hatch out or they died shortly after hatching, before becoming infective larvae.

(2) Eggs remained practically unchanged, not developing. Eggs in *Jar No. 1* were unchanged August 17th-September 1st, and with no more than a very little development until September 16th. None were observed to develop into worm or pre-worm stages. *Jar No. 2* showed no development August 30th-September 3rd, and not more than a very little development until September 13th. None were observed to reach worm stage; and none to reach the pre-worm stage after September 5th.

(3) Degeneration began within less than four weeks and progressed until all eggs lost viability and finally disappeared. In *Jar No. 1* degeneration was first observed September 8th; by October 30th, or in eleven weeks, most eggs were degenerated; and by November 21st all were degenerated in both jars. By December 4th, or in three and one-half months, both jars were negative; and cultures of whole samples showed both negative by December 11th. Earlier cultures might have made this date earlier. An interesting problem is indicated here: at what period between September 8th and December 11th had all these eggs lost their viability? No development was really noted after the middle of September, or after one month's storage.

(4) It should be noted that the temperature was just right for rapid development of eggs; and they were doing so until the feces were diluted with water.

Chinese Night Soil Jar Experiments

After several months of trying out different methods the following experiment was set up, running from May 13th to September 22nd. Chinese night soil *kang* (*kong*- -缸) or jars, with a capacity of about fifteen gallons each, exactly like those used by Chinese farmers in storing night soil in the fields, were taken, and into them night soil, from a water closet used by twenty workmen on the college farm, was poured. This insured a sufficient amount of material to fill one storage jar each time, and to have the material always fresh. Examinations showed a moderate amount of viable hookworm. Fresh jars were set up at intervals of ten days to two weeks. Frequent examinations were made by the salt flotation method, and by culturing and isolating larvae. Cultures were made by mixing with sterile earth, after method devised by Ackert. The jars were placed in the open air and were set up exactly as are the storage jars actually used by Chinese farmers, except that they were covered so that the contents might not be diluted by the heavy rains incident to this season of the year.

Tables Nos. 2 and 3 reveal the findings of these experiments, as follows:

(1) Jars Nos. 1, 2, 3, and 4 showed degenerated eggs fifteen, forty, and fifty days respectively after eggs are shown to be non-viable by culturing. This suggests several questions. How long do eggs remain apparently good and alive after they are incapable of developing into worms? How long will eggs persist after visible degeneration begins? This indicates that too much reliance cannot be placed on egg findings alone, and shows the necessity of also using cultures.

(2) Jars 1, 2, and 3 might have been shown to be negative twenty and ten days earlier, and Jars 6, 7, and 8 a month or more earlier, if more frequent cultures had been made. Jars 8 and 11 did not mean much because no good, positive findings were made. This leaves Jars 4, 5, 9, and 10, which bring within well defined limits the time when eggs lost viability. These were last proved positive, either by salt flotation or culture, 19, 8, 19, and 8 days, respectively, after being set up; and proved negative by

Table No. I—Glass Jar Experiment with Feces Diluted with Water

Date 1922		Findings in Jar No. 1	Findings in Jar No. 2	Temp. Cent.
Aug.	15	Two celled to worms in eggs		27.6°
„	17	Four celled to morula. No worms in eggs		27.0
„	19	Same as above. No development		23.9
„	20	„ „		27.2
„	25	„ „		24.5
„	26	„ „	Eggs, all stages	26.5
„	27	„ „		25.7
„	28	„ „		26.9
„	30	„ „	Morula and gastrula	24.3
„	31	„ „	„ „ „	25.5
Sept.	1	Only slightly advanced	„ „ „	25.2
„	2	Some slightly beyond morula	„ „ „	25.6
„	3	„ „ „ „	Some almost worms. Most same as before	25.4
„	4	Eight-sixteen celled. A few further advanced	Abundant younger stages to gastrula	24.5
„	5	Eight celled, morula	Only morula to not quite worms	25.4
„	6	„ „ „	Some normal, some badly shrunken	25.1
„	7	„ „ „ Few eggs evident	Same but few	25.8
„	8	„ „ „ Signs of disintegration	No advance	27.1
„	9	Eight celled, morula and beyond. Some degenerated eggs	Fewer	25.9
„	10	Same as Sept. 9. Few eggs	Not advanced	26.8
„	11	Few celled, advanced eggs. Eggs numerous	Advanced stages few	26.2
„	12	Still has eggs; some degenerated	Few many celled	27.1
„	13	„ „	Very few eggs	25.5
„	14	Eggs advanced; some degenerated	Few, all advanced stage	26.0
„	15	„ „ ; few degenerated	Advanced stages and few	26.0
„	16	Eight celled to advanced; numerous	A few eight-celled. Numerous advanced	25.8
„	19	Eggs advanced	Advanced stages and few	20.5
„	20	„ „	Scarce	22.4
„	29	Degenerated eggs	Few few celled eggs	24.7
Oct.	3	Few eggs	Few celled eggs	20.4
„	9	Few; rounder, some degenerated	Few rounder, some degenerated	23.7
„	26	One peculiar egg	Negative	19.7
„	30	Few very good; many degenerated		21.3
Nov.	21	Hooked; addled; but numerous	Addled, but numerous	17.6
Dec.	4	Negative	Negative	16.0
„	11	Cultured sample	Cultured sample	11.8
„	18	Culture negative	Culture negative	9.6

Average	Temperature	August	26.6	Centigrade
„	„	September	24 9	„
„	„	October	21.2	„
„	„	November	15.5	„
„	„	December	11.7	„

Table No. II—Hookworm Viability Experiment

Divisional lines:

……………Last time apparently good eggs were observed
▭▭▭▭▭▭Last time degenerated eggs were observed
〰〰〰〰Culture first found to be negative
◆◆◆◆◆◆◆◆◆ Culture last found to be positive

Abbreviations:

S.U.K.=Set up new jar of night soil
Hw.=Hookworm eggs
Hwl.=Hookworm larvae
Deg.=Degenerated hookworm eggs
Cult.=Set up culture from jar
+=Positive
—=Negative

Date	Jar No. I and II	Jar No. III	Jar No. IV	Jar No. V	Jar No. VI	Jar No. VII	Jar No. VIII	Jar No. IX	Jar No. X	Jar No. XI	Jar No. XII	Av. Temp.
May 13	S. U. K.											May 24.2C.
,, 22	Hw. +	S.U.K.; Hw. +										
June 5	Hw. +	Hw. +										
,, 7			S. U. K.									
,, 12	Hw. +	Hw. +	Hw. +									
,, 25				S. U. K.								
,, 26	Deg. Hw.	Deg. Hw.	4-eight-celled and Deg. Hw. +									June 25.7C.
,, 28				Hw. +, 4 to many celled.								
July 3	Deg. Hw.	Deg. Hw.	Deg. Hw.	Hw. +								
,, 4	Cult.	Cult.	Cult.	Cult.								
,, 10					S. U. K.							July 26.4C.
,, 17	Cult. of 7/4 Hwl.—	Cult. of 7/4 Hwl.—	Cult. of 7/4 Hwl.—	Cult. of 7/4 Hwl. +								
,, 19	Deg. Hw. Cult.	Hw.—Cult.	Hw.—Cult.	1 Deg. Hw. Cult.	Hw.—Cult.	S.U.K. Hw. Cult.						
,, 24			1 Deg. Hw.	Hw.—	Hw.—	Many good Hw. +						
,, 28							S.U.K.					
Aug. 9	Cult. of 7/19 Hwl.—	Cult. of 7/19 Hwl.—	Cult. of 7/19 Hwl.—	Cult. of 7/19 Hwl.—	Cult. of 7/19 Hwl. +	Cult. of 7/19 Hwl. +		S.U.K.				
,, 14	Hw.—	1 Deg. Hw.	Hw.—	Hw.—	Hw.—	Hw.—	Hw.—	Hw. +				Aug. 26.4C.
,, 20									S.U.K.			
,, 28	Hw.—	Hw.—	Deg. Hw.	Hw.—	Hw.—	Hw. +	Hw.—	Hw. +	Hw. +			
Sept. 1										S.U.K.		Sept. 25.2C.
,, 15											S.U.K.	
,, 17				Hw.—Cult.	Hw.—Cult.	Hw.—Cult.	Deg. Hw. Cult.	Hw.—Cult.	Deg. Hw. Cult.	Hw.—Cult.	Hw. + Cult.	
,, 22				Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl.—	Cult. of 9/17 Hwl. +	

Table No. III

SUMMARY OF TABLE No. II

Jar No.	Date Set Up	No. Days proved positive	Method of examination	No. days till degenerated eggs disappeared	No. days till proved negative by culture
1 & 2	May 13	30	Salt flotation	67	52
3	„ 22	21	„ „	84	43
4	June 7	19		82	31
5	„ 25	8	„ „	16	24
6	July 10	9	„ „ and culture		69
7	„ 19	40	„		60
8	„ 28	0	Salt flotation	39	51
9	Aug. 9	19	Salt flotation	28	39
10	„ 20	8	„ „	Negative	28
11	Sept. 1	Negative	„ „	„	
12	„ 15	2		Still positive ,Sept. 17	

Table No. IV.

1. SOIL SAMPLES FROM STORAGE JARS ON C.C.C. FARM.

No.	Date	Location	Contamination	Conditions—Soil	Findings
	1922				
1	Aug. 17	Kong at workmen's barracks	Overflow & spilling from jar	Slightly damp clay	Neg.
2	„ 19	Jar near Silk Bldg.	„ „	Clay damp shade	Fn.
3	„ 25	„ „	„ „	Damp clay „	„
5	Sept. 11	„ „	„ „	„ „ „	Neg.
6	„ 13	„ „	„ „	„ „ „	Fn.
7	„ 13	„ „	„ „	„ „ „	Neg.
11	„ 21	„ „	„ „	„ „ „	Fn.
12	„ 23	„ „	„ „	„ „ „	„
13	Oct. 6	Jar near Cadbury house	„ „	Slightly damp Clay	„
14	„ 6	„ „	„ „	„ „ „	„
	1923				
33	June 22	Path by jar	Occasional spilling	„ „ „ loam	„
38	„ 25	„ „ „	„ „	„ „ „ „	„
39	„ 25	Near jar	Where night soil would run over	Damp loam	„
55	July 6	Experiment jar	Overflow	Wet loam clay	„
56	„ 6	„ „	„	„ „ „	„
57	„ 6	„ „	„	„ „ „	„
58	„ 6	„ „	„	„ „ „	„

Hw= Hookworm larvae

Fn = Free living nematodes

Table No. IV.

2. SOIL SAMPLES TAKEN FROM W.C.'s ON C.C.C. FARM.

No.	Date	Location	Contamination	Conditions—Soil	Findings
4	1922 Aug. 25	Privy near Silk Building	Constant	Damp sand & earth	Fn.
8	Sept. 14	" "	"	" " "	Neg.
9	" 14	" "	"	" " "	Fn.
10	" 14	" "	"	" " "	"
20	1923 June 12	" "	"	" " "	" Hw.
32	" 12	" "	"	" " "	" "
36	" 12	Boys' School privy	"	Wet " "	Fn.

3. SOIL SAMPLES TAKEN FROM W.C's IN KAUFUNGWONG VILLAGE.

No.	Date	Location	Contamination	Conditions—Soil	Findings
40	June 28	W. C. jars at Kaufungwong	Spilling around W.C.	Damp loam clay	Fn.
41	" 28	" " "	" " "	" " "	"
42	" 28	" " "	" " "	" " "	"
43	" 28	" " "	" " "	" " "	"
48	July 2	" " "	" " "	" " "	" Hw.
49	" 2	" " "	" " "	" " "	Fn.
50	" 2	" " "	" " "	" " "	" Hw.
51	" 2	" " "	" " "	" " "	" "
52	" 2	" " "	" " "	" " "	Neg.
53	" 2	" " "	" " "	" " "	Fn. Hw.
54	" 2	" " "	" " "	" " "	2 Fn.

4. SOIL SAMPLES FROM FIELDS ON C.C.C. FARM

No.	Date	Location	Condition	Contamination	Findings
15	Oct. 29'22	Foot Papaya Tree	Slightly Damp Clay	Fertilized 2 Mo.	Fn. Hw.—
16	" 29	" Pomelo "	" " "	" 1 "	" Hw+
17	" 29	" Papaya "	" " "	" 15 Da.	" "
19	" 29	Corn Bed	" " "	" 2 Wks.	" Hw.
21	June 12'23	Bean Bed	Moist Shady Sand Loam	" 10 "	" "
22	" 12	" "	" " " "	" 9 "	" "
23	" 12	" "	" " " "	" 7 "	" "
24	" 18	Ft. Papaya Tree	Wet Loam	" 1 Wk.	" "
25	" 18	" " "	" "	" 2 "	"
26	" 18	" " "	" "	" 3 "	"
27	" 18	Ditch Btwn. Pap. Tree	Damp Sand Loam	" 1 "	" Hw.
28	" 21	Ft. Papaya Tree	" " "	" 4 "	"
29	" 21	" " "	" " "	" 4 "	" Hw.
30	" 21	" " "	" " "	" 6 "	" "
31	" 21	Ditch Btwn. Pap. Tree	" "	"	"
34	" 22	Same as No. 21	" " "Shady	" 17 Da.	"
35	" 22	" " " 21	" " " "	" 18 "	"
37	" 25	Papaya Tree	" " Clay	" 2 Mo.	"
44	" 29	Same as 21 "	" " Loam	" 1 "	"
45	" 29	" " 21	" " "	" 1 "	"
46	" 29	" " 21	" " "	" 1 "	"
47	" 29	Ditch Btwn. Rows 45&44	" " "	" 1 "	"

Hw= Hookworm larvae

Fn = Free living nematodes

culture, 31,24, 39, and 28 days, respectively, after being set up. It would appear that eggs in jars lose their viability somewhere between the third and sixth week after storage.

(3) This experiment is being repeated with material containing a larger number of eggs, with egg counts and cultures at regular intervals; and it will be carried on through the various seasons. Also experiments are being carried out to determine how storage in these Chinese jars affects the fertilizing value of the night soil. The results will be reported later.

Soil Sample Readings

During 1922 and 1923 soil samples were taken from various places in order to find, if possible, where there might be soil infestation of hookworm larvae. These investigations revealed that there was practically no indiscriminate soil pollution, as all night soil was of such value as to be carefully saved. The possible sources of pollution which were observed were three: privies, storage jars, and the application of night soil as fertilizer. A fourth possibility is in the home for there women use buckets. No samples were taken from this source, however; and the care used in emptying, as also other conditions, would seem to make the production of infective larvae less probable here than in the public privy.

The privies on the college farm grounds were palm leaf matsheds. The fecal matter was dropped on sand, from which it was removed to the storage jars by workmen. These privies were used by groups of from six to twenty farm workmen, about two-thirds of whom were infested with hookworm. The privies in the village of *Kaufungwong* (舊鳳凰) consist of ordinary storage jars, on which are placed two strips of wood upon which the users squat. The jars investigated were three in number and were used by about forty people, at least moderately infected with hookworm. The storage jars examined were the earthenware ones, common in these parts, and already mentioned as holding fifteen to twenty gallons. These are usually so placed near the fields as to be convenient for the application of the fertilizer therein contained to the fields.

Table No. 4 gives the findings of these soil samples, in four groups: (1) storage jars; (2) water closets on college farm; (3) *Kaufungwong* (舊鳳凰) privies; and (4) samples from fields where night soil had been applied. These are as follows:

(1) Of seventeen samples from around the bases of five different storage jars, known to contain hookworm eggs, all were negative. These jars always had hookworm eggs in them, whenever examined, and they were emptied and refilled at frequent intervals. As they seldom were covered, during hard rains they would frequently overflow.

(2) Of seven soil samples from the privies on the college farm two were positive. One privy, found negative, was used exclusively by school children who had very little hookworm. The other six were from a privy used by about twenty workmen, two-thirds of whom had hook worm.

(3) Of the eleven samples from the three jars used by *Kaufung-wong* （舊鳳凰） villagers, four were found positive.

(4) Of the soil samples from the night soil fertilized fields, three were from a bean patch, fertilized ten, nine, and seven days before. All had hookworm larvae. Two samples taken ten days later from the same place were negative. Four more samples taken after the fertilizer had been on the fields twenty-six to twenty-seven days were also found negative.

(5) Omitting the second and third sets of samples from the bean patch, there remained seventeen samples of which ten were positive.

(6) Of the negative samples two were from soil fertilized two months before; one, four weeks before; one, three weeks before; two, two weeks before; one not stated. Of the positive samples one was from soil fertilized six weeks before; two, one month; three, two weeks; one, ten days; one, nine days; and two, one week before. These were all observed under favorable conditions of moisture, temperature, and shade, but some had been subjected to heavy rains which may have washed away the larvae. Under the conditions named infective larvae were found from one to six weeks after an application of fertilizer. None were found later than six weeks.

Summary

Under frequent, almost daily, examination of hookworm eggs, in feces diluted with water, it was noted: (a) the eggs were not observed to develop into worms; no worms left the container; and if any were hatched they evidently died very soon; (b) the eggs remained practically stationary with little development; no development was noted after one month's storage. Degeneration began in less than four weeks and progressed until all eggs lost viability and disappeared.

In a series of jars containing night soil with hookworm eggs, and set up under conditions similar to native storage jars, it was found: (a) that degenerated eggs remained in the jars ten, forty, and fifty days after it was negative for living worms by culture method. This indicates the need for a good method for determining, otherwise than by culture, when eggs have lost their viability. It also suggests several questions of interest. How long do eggs remain apparently good and active after they are incapable of developing worms? How long will eggs persist after visible degeneration begins? (b) Eggs lost their viability in between three and six weeks of storage. Farmers ordinarily store night soil ten to fourteen days before using it on the fields. There remains, then, the question as to what is the effect of four weeks' additional storage. Does the night soil improve or deteriorate in fertilizing efficiency? If it deteriorates what can be done to make it desirable to store it four more weeks? Or what can be done to destroy the eggs earlier?

The findings from soil samples show that: (a) the spilling and overflow from storage jars are negligible as a source of infection by hookworm; (b) there would be danger under some conditions around water closets; (c) the principal source of infection is night soil used as fertilizer;

(d) six weeks was the longest time after fertilization that infective hookworm larvae were found in the soil; (e) infective larvae were found in a bean patch seven to ten days after fertilization, but were not found in the same place twenty and twenty-seven days after fertilization.

Conclusion

There should be further investigations to verify these findings for this locality. The next step is to find out what effect storage has upon the fertilizing value of night soil. Should it be as good or better after storage the hookworm problem in South China is greatly simplified.

Since commercial fertilizers are rapidly coming into use in China and are found unsatisfactory because they leave the soil in a hard, unworkable condition, a new line of stùdy is opened up. What effect would the various fertilizers, when mixed with night soil, have on the viability of hookworm eggs, as also upon the preservation of the fertilizing value of the night soil? Could the right mixture be found—one that would be both profitable and safe—then a program could be drawn up upon sound lines for the eradication of hookworm, and with the prospect, in addition, of an improved fertilizer for the use of the farmer.

Acknowledgment

The writer wishes to to acknowledge the part Mr. A. S. Campbell, of the Biology Department of the Canton Christian College, had in this work. From the beginning in 1922 until he left for the United States in June, 1923 he had an equal share in all experiments and observations, especially those in the fall of 1922. The reports of the Hookworm Commission, headed by Dr. W. W. Cort of Johns Hopkins School of Hygiene and Public Health, to Trinidad in 1921 and to Porto Rico in 1922, furnished many valuable suggestions. Thanks are due to the agricultural and medical members of the staff of the Canton Christian College, and to others, for their cooperation.

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A PRELIMINARY LIST OF THE ANTS RECORDED FROM CHINA

N. Gist Gee

CHINA MEDICAL BOARD, PEKING

(Submitted for publication, June 25th, 1924.)

Foreword

One of the greatest handicaps felt by every worker in the natural history of China is the fact that no published records are available giving the results of the work of those who have studied special groups of plants or animals.

Professor William M. Wheeler, of Bussey Institution, has been much interested in Chinese Ants and has kindly identified recent collections which have been sent to him by Prof. C. W. Howard of Canton, Prof. A. P. Jacot of Tsinan, Prof. S. F. Light of Amoy, and the writer. It is through Professor Wheeler's kindness that we are able to publish this preliminary list which we hope will be a means of encouraging others to make collections and give us a more complete list of the ants of the country.

The matter of collecting is simple,: drop the ants in a small bottle of 95% alcohol until they are thoroughly preserved and then wrap them in cloth, not cotton, wet in alcohol and mail them in a tin box. The writer will be glad to receive such collections and will undertake to send them all to Prof. Wheeler for identification.

We are indebted to Prof. H. S. Chang of Nanking for the references to literature on Chinese ants appended to this list.

FAMILY FORMICIDAE

SUBFAMILY CERAPACHYINAE

Cerapachys F. Smith

1.—*C. risi* Forel. Victoria Peak, Hongkong (Fr. Ris).

SUBFAMILY PONERINAE

Stictoponera Mayr

2.—*S. menadensis* Mayr subsp. *bicolor* Emery. Hongkong (Terry); Tingu,* S. China (Howard).

Harpegnathos Jerdon

3.—*H. saltator* Jerdon. China

4.—*H. venator* F. Smith. Hongkong.

5.—*H. venator* var. *rugosus* Mayr. Hongkong.

Odontoponera Mayr

6.—*O. transversa* F. Smith. Province of Fukien (G. Siemssen); Canton (Howard); Tungan, Hainan (Light).

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* The editors have not attempted to standardize the spelling of the names of places except those of South China with which they are familiar.

Diacamma Mayr

7.—*D. rugosum* Le Guillou subsp. *geometricum* F. Smith var. *anceps* Emery. Hongkong (Terry); Canton (Howard); Kachek, Hainan (Light).

Bothroponera Mayr

8.—*B. rufipes* Jerdon. Hongkong (Terry).

Ectomemyrmer Mayr

9.—*E. javanus* Mayr. Mokanshan (Gee).

10.—*E. astutus* Sm. Tingu, S. China (Howard).

Euponera

(Subgen. **Brachyponera** Emery)

11.—*E. luteipes* Mayr. Hongkong (Terry).

12.—*E. darwini* (Forel) var. *indica* Emery. Kachek, Hainan (Light).

13.—*E. nigrita* Emery subsp. *chinensis* Emery. Soochow (Gee); Shanghai.

Leptogenys Roger

(Subgen. **Lobepelta** Mayr)

14.—*L. chinensis* Mayr. China.

15.—*L. diminuta* Sm. Tingu (Howard).

16.—*L. kitteli* Mayr. Province of Fukien (G. Siemssen).

17.—*L. kitteli* subsp. *altisquamis* Forel. Hongkong (Terry).

18.—*L. peuqueti* Ern. Andre. Mokanshan (Gee).

Anochetus Mayr

19.—*A. risi* Forel. Victoria Peak, Hongkong (Fr. Ris).

Odontomachus Latreille

20.—*O. haematoda* L. Hongkong (Terry); Mokanshan (Gee).

21.—*O. monticola* Emery subsp. *pauperculus* Wheeler. Mokanshan (Gee).

SUBFAMILY DORYLINAE

Dorylus Fabr.

(Subgen. **Alaopone** Emery)

22.—*D. orientalis* Westw. Province of Fukien (G. Siemssen).

Aenictus Shuckard

23.—*A. fergusoni* Forel. Mokanshan (Gee).

SUBFAMILY PSEUDOMYRMINAE

Tetraponera Smith

24.—*T. binghami* Forel. Hongkong (Terry).

25.—*T. allaborans* Walk. Canton (Howard).

26.—*T. rufonigra* (Jerdon). Kachek, Hainan (Light).

SUBFAMILY MYRMICINAE

Myrmica Latreille

27.—*M. scabrinodis* Nyl. subsp. *schencki* Emery. China.

Aphaenogaster Mayr

28.—*A. exasperata* Wheeler. Mokanshan (Gee).

29.—*A. geei* Wheeler. Soochow (Gee).

Messor Forel

30.—*M. barbarus* L subsp. *capitatus* Latr. var. *rugosus* Ern. Andre—Kiangsee Yangtsi (Xantus).

31.—*M. lobulifer* Emery. Shanghai; Mongolia; Soochow (Gee); Tsinan (Jacot).

Pheidole Westw.

32.—*P. rhombinoda* Mayr. Soochow and Mokanshan (Gee); Tsinan (Jacot).

33.—*P. nodifera* F. Smith. North China.

Cremastogaster Lund

34.—*C. artifex* Mayr. Province of Fukien (G. Siemssen); Kachek, Hainan (Light).

35.—*C. laboriosa* F. Smith. Soochow (Gee).

36.—*C. rogenhoferi* Mayr. Province of Fukien (G. Siemssen); So-foo-shan 100-1000 ft. (Muir); Canton (Howard).

37.—*C. subnuda* Mayr. subsp. *contempta* Mayr. Province of Fukien (G. Siemssen); Thinthong (Xantus).

38.—*C. subdentata* Mayr. Szetachwan, Valley Tunkgoche, Western China (Potanin).

39.—*C. egidyi* Forel. Hongkong (Arth. Muller).

40.—*C. dohrni* Mayr subsp. *kiangsiensis* Forel Province of Kiangsi (Ern. Andre).

41.—*C. biroi* Mayr. Canton (Howard).

(Subgen. **Orthocrema** Santschi)

42.—*C sordidula* Nyl. Soochow (Gee).

Monomorium Mayr

43.—*M. pharaonis* L. Province of Fukien (G. Siemssen); Canton (Howard).

44.—*M. minutum* (Mayr). Tsinan; Chao Yang An, Peking (Jacot).

45.—*M. gracillimum* var. *mayri* Forel. Hainan (Light).

46.—*M. carbonarium* F. Smith. Between Shanghai and Foochow (Gee); Canton (Howard).

Cardiocondyla

47.—*C. nuda* Mayr. Canton (Howard).

Colenopsis Westwood

48.—*C soochowensis* Wheeler. Soochow (Gee).

49.—*C. jacoti* Wheeler. Tsinan (Jacot).

50.—*C. jacoti* subsp. *pekingensis* (Wheeler). Chao Yang An, Peking (Jacot).

Pheidologeton Mayr

51.—*P. diversus* (Jerdon) Hongkong (Terry); Macao (Terry); Canton (Howard); Kachek, Amoy (Light).

52.—*P. diversus* (Jerdon) var. *ficta* Forel. Victoria Peak, Hongkong (Ris).

53.—*P. affinis* Jerdon. Hongkong (Terry).

54—*P. vespillo* Wheeler. Mokanshan (Gee).

Cataulacus

55.—*C. granulatus* (Latr.). Kachek (Light).

Carebara F. Smith

56.—*C. castanea* F. Smith. Hongkong.

Pristomyrmex Mayr

57.—*P. japonicus* Forel. Soochow and Mokanshan (Gee).

Myrmecina Mayr

58.—*M. graminicola* Latr. subsp. *sinensis* Wheeler. Mokanshan (Gee).

Strumigenys

59.—*S. godeffroyi* Mayr var. *lewisi* Cameron. Tsingtao (Jacot).

Meranoplus F. Smith

60.—*M. bicolor* Guerin. Hongkong (Terry); Kachek (Light).

Tetramorium Mayr

61.—*T. caespitum* (L.) Soochow and Mokanshan (Gee); Western Hills, Peking (L. I. Mead); Hongkong (Novara).

62.—*T. caespitum* (L.) subsp. *simileve* Andre, var. *jacoti* Wheeler. Peking (Jacot).

SUBFAMILY DOLICHODERINAE

Dolichoderus Lund

(Subgen. **Hypoclinea** Mayr)

63.—*D. taprobanae* F. Smith var. *gracilipes* Mayr. Canton (Howard).

64.—*D. affinis* Emery., var. *nigricans* Emery. Filoi and Lokong, S. China (Howard).

65.—*D. sinensis* Wheeler. Canton (Howard).

Liometopum Mayr

66.—*L. sinense* Wheeler. Soochow (Gee)

67.—*L. sinense* var. *sericatum* Wheeler. Mokanshan (Gee).

Iridomyrmex Mayr

68.—*I. anceps* Roger. Between Shanghai and Foochow (Gee); Canton (Howard).

69.—*I. glaber* Mayr. Soochow (Gee).

Bothriomyrmex Mayr

70.—*B. wroughtoni* Forel var. *victoriae* Forel. Victoria Peak, Hongkong (Fr. Ris).

71.—*B. myops* Forel. Hongkong (Fr. Ris).

Tapinoma Forster.

72.—*T. melanocephalum* Fabr. Macao (Muir); Kachek, Hainan (Light).

73.—*T. indicum* Forel. Tingu, S. China (Howard).

Technomyrmex Mayr

74.—*T. albipes* F. Smith. Hongkong (Novara); Canton (Howard); Tsingtao, Tsinan (Jacot).

75.—*T. modiglianii* Emery subsp. *elatior* Forel. Waichow, East River (Muir).

SUBFAMILY FORMICINAE

Plagiolepis Mayr

76.—*P. pygmaea* Latr. China.

77.—*P. longipes* Jerdon. Hongkong (Novara); Canton (Howard); Kachek, Hainan (Light).

78.—*P. rothneyi* Forel. Canton (Howard).

79.—*P. rothneyi* Forel subsp. *watsoni* Forel. Macao and Soo-foo-shan, 100-1000 ft. (Muir).

80.—*P. wroughtoni* Forel. Tsingtao; Chao Yang An, Peking (Jacot).

Pronolepis Mayr

81.—*P. yerburyi* Forel. Province of Fukien (G. Siemssen); Canton (Howard).

(Subgen. **Nylanderia** Emery)

82.—*P. emmae* Forel. Hongkong; Mokanshan (Gee).

83.—*P. flavipes* F. Smith. Soochow (Gee).

84.—*P. longicornis* Latr. Hongkong; Canton (Howard).

Paratrechina

85.—*P. bourbonica* (Forel) subsp. *bengalensis* (Forel). Kachek, Hainan (Light).

Lasius Fabr.

86.—*L. niger* L. Sze-tschwan, River Pasyn-Kou, Western China (Potanin); Peitaiho, Northern China (Gee).

(Subgen. **Dendrolasius** Ruzsky)

87.—*L. fuliginosus* Latr. Hongkong (Muir).

Formica L.

88.—*F. truncicola* Nyl. var. *sinensis* Wheeler. Chun-King, Western China (Amer. Mus. Nat. Hist.).

89.—*F. fusca* L. Sze-tschwan, Lunganfu, Chodzy-gou Gorge 6000 (Berezovskij); Maotsch-zou, Mataigi (Potanin), Western China.

90.—*F. fusca* var. *japonica* Motsch. Mokanshan (Gee); Chun-King (Amer Mus. Nat. Hist.).

91.—*F. jacoti* Wheeler. Chao Yang An (Jacot).

92.—*F. picea* Nyl. China.

93.—*F. rufibarbis* Fabr. var. *subpilosa* Ruzsky Western China; Basin of Hoangho River (Roberovskij and Kozlov).

94.—*F. rufibarbis* Fabr. var. *orientalis* Wheeler. Nu Ku Kow, Tsingtao (Jacot).

Oecophylla Fabr.

95.—*O. smaragdina* Fabr. Sun Wui Dist; S. China (Howard).

Gesomyrmex

96.—*G. howardi* Wheeler. Canton, (Howard).

Camponotus Mayr

(Subgen. **Camponotus**)

97.—*C. herculeanus* L. subsp. *japonicus* Mayr. Western China; Sze-tschwan, Putsch-Zan, Zatsch-zou (Potanin).

98.—*C. herculeanus* L. var. *aterrimus* Emery. Western Hills, Peking (L. I. Mead); Peitaiho. North China (Gee); Soochow and Mokanshan (Gee), Chao Yang An (Jacot).

99.—*C. caryae* Fitch subsp. *vitiosus* F. Smith. Province of Fukien, China (G. Siemssen).

100.—*C. caryae* subsp. *quadrinotatus* Forel. Province of Fukien (G. Siemssen); Soochow (Gee).

(Subgen. **Dinomyrmex** Ashmead)

101.—*C. dorycus* F. Smith subsp. *carin* Emery, Mokanshan (Gee); Kachek (Light).

(Subgen. **Myrmoturba** Forel)

102.—*C. maculatus* Fabr. subsp. *compressus* F. Smith. Shanghai; Hongkong.

103.—*C.* subsp. *hongkongensis* Forel. Hongkong (Arth. Muller).

104.—*C. festinus* F. Smith. China.

105.—*C. barbatus* Roger subsp. *taylori* Forel. Victoria Peak, Hongkong (Fr. Ris).

106.—*C.* subsp. *albosparsus* Forel. Between Shanghai and Foochow (Gee); Soochow (Gee); Canton (Howard).

107.—*C. friedae* Forel. Between Shanghai and Foochow (Gee).

108.—*C. mitis* Sm. Canton (Howard).

(Subgen. **Myrmicosericus** Forel)

109.—*C. rufoglaucus* Jerdon subsp *paria* Emery. Macao (Muir); Filoi; S. China (Howard); Kachek (Light).

(Subgen. **Myrmothrix** Forel)

110.—*C. nicobarensis* Mayr. Province of Fukien (G. Siemssen); Canton (Howard).

111.—*C. nicobarensis* var. *exiguoguttatus* Forel. Hongkong (Terry); Waichow, East River (Muir); Cochin China (Lyons Mus.); Tungan and Kachek (Light).

(Subgen. **Colobopsis** Mayr)

112.—*C. laotsei* Wheeler. Mokanshan (Gee).

(Subgen. **Polyrhachis**)

113.—*C. lamellidens* F. Smith. Mokanshan (Gee).

(Subgen. **Myrma** Bilberg)

114.—*C. tyrannicus* F. Smith. Hongkong.

115.—*C. vigilans* F. Smith. Hongkong.

116.—*C. mayri* Roger. China, Canton (Howard); Kachek (Light).

117.—*C. pyrgops* Viehmeyer. Hongkong (Terry); Mokanshan (Gee); Province of Fukien (G. Siemssen).

118.—*C. proxima* Roger. Province of Fukien (G. Siemssen).

(Subgen. **Myrmhopla** Forel)

119.—*C. dives* F. Smith. Mokanshan (Gee); Hongkong (Ris); Foochow and Fukien (G. Siemssen); Kachek and Amoy (Light); Canton (Howard).

120.—*C. hippomanes* F. Smith var. *moesta* Emery. Mokanshan (Gee).

(Subgen. **Cyrtomyrma**)

121.—*C. rastellata* F. Smith subsp. *laevior* Roger var. *debilis* Emery. Kachek (Light) Canton (Howard).

(Subgen. **Myrmatopa** Forel)

122.—*C. tschu* Forel. China.

123.—*C. schang* Forel. China.

REFERENCES

1773—Degeer. Mem. Sero. Hist. Insect, III, page 603.

1793—Fabricius. Entom. Syst. II, page 355.

1802—Latreille. Hist. Nat. Fourmis, page 88.

1836—Say. Boston Jour. Nat. Hist. Vol. I, page 287.

1841—Westwood. Ann. and Mag. Nat. Hist. VI, page 88.

1846—Uylander. Acta. Soc. Se. Fennie II, 3, page 32.

1851—Jerdon. Madras Jour. Litt. Sc., Vol. 17, pages 116-119

1854—Jerdon. Ann. and Mag. Nat. Hist. (2), 13, page 102.

1857—Smith. Journal Proc. Linn. Soc. Zool. II, page 53.

1858—Smith. Cat. Hymen. Brit. Mus. VI, pages 69-178.

1862—Mayr. Verh. Zool. Bot Ges. Wein. XII, page 723.

1863—Mayr. Vech. *Zool* Bot. Ges. Wein. XIII, page 408.
1867—Buckley. Proc. Ent. Soc. Phil. VI, page 342.
1870—Mayr. Verh. *Zool.* Bot. Ges. Wein. XX, page 965.
1874—Smith. Tran. Ent. Soc. London, pages 403-404.
1879—Forel. Bull. Soc. Vand. Ac. Nat. 16, page 81.
1886—Mayr. Verh. *Zool.* Bot. Ges. Wein. 36, pages 360-363.
1889—Rothney. Trans. Ent. Soc. London, page 373.
1890—Mayr. Hor. Soc. Ent. Ross. 24, page 279
1893—Dalla Torre. Cat. Hymen. pages 1-274.
1894—Emery. Ann. Mus. Hor. Nat. Genova, Vol. 34, page 459.
1895—Forel. Jour. Bombay Nat. Hist. Soc. Vol. 9, page 469.
1900— „ „ „ „ „ „ „ 13, „ 60.
1906—Paulton. Trans. Ent. Soc. London, page 344.
1912—Sharp. Trans. Ent. Soc. London, page 274.
1913—Emery. Genera Insectorum, Vol. 137, pages 1-50.
1913— „ „ „ „ 118, „ 1-125.
1915—Sharp. *Zool.* Record, pages 162-163.
1918—Gee. Some Chinese Hymenoptera. page 1.
1922—Wheeler. Psyche, Vol. 28, No. 4, pages 110-115.
1922— „ Bull. Mus. Comp. *Zoology*, Vol. LXIX, No. 7, Chinese ants, pages 529-547.
1923— „ Am. Museum Novitates, No. 69.

THE CULTURED CITRUS ANT OF SOUTH CHINA.

By

G. W. Groff and C. W. Howard

Chinese citrus growers in Szewui (四會), P'unu (番禺), and other fruit producing districts of Kwangtung commonly practice the culture of an ant which they claim kills off destructive insects, and is therefore a very necessary adjunct to successful citrus culture. This practice was observed and photographed during citrus investigations in the province for the Office of Crop Physiology and Breeding Investigations of the United States Department of Agriculture in 1918. In the spring of 1919 several nests were secured for special observation on the college farm. Mr. Gist Gee's compilation of Chinese ants leads us to record our observations of this ant, *Oecophylla smaragdina* Fabr., the well-known red tree ant of the Old World Tropics.

In the Szewui (四會) region Chinese citrus growers invariably practice rearing these ants in their orchards. This region is reached from Shekwaitong (石闈塘) station of the Kwongsam (廣三) branch of the Yuet Han Railway, proceeding through Namhoi (南海) and Samshui (三水) districts. At Samshui a passage boat is taken to Szewui city, affording a most interesting trip. The Szewui mandarin orange (四會柑) is one of the most famous of the Kwangtung citrus fruits in that it is not only delicious in flavor but is remarkably free from skin blemishes and is an excellent keeper. This loose skin fruit has a most interesting history, with every evidence that during recent decades its cultivation has diminished. Formerly the orchards were located at a place called Sheunglam (上林), but now this region is said not to produce any of these fruits and all the present-day orchards are located at Saisha (西沙). But even here the industry seems very limited in scope.

At Saisha the growers told us that their region is too cold to winter these ants but that in the Ts'ingun (清遠) district a regular business has developed in the rearing of these beneficial insects for Szewui (四會) fruit growers. The nests are purchased in Ts'ingun during the Chinese first and second months of the year (usually February and March), shortly before the break of spring. The ants have not yet emerged from the nests, and after the latter have been placed in the crutches of the citrus trees, some candle wax is smeared about the branches to prevent them from running away when they do venture out. At this time of the year it is very easy to transport the nests, whereas if they wait until the third or fourth month, after the weather is warmer, the ants will escape in transit. As soon as the warm weather sets in the ants become active and each colony builds a new and larger nest in the citrus tree, weaving together the leaves of the orange as shown in the illustration. At this time of the year the growers encourage them by stripping bamboo which they use to build bridges from tree to tree, over which the ants can cross. These they place at least six feet above ground so as to prevent any interference in the

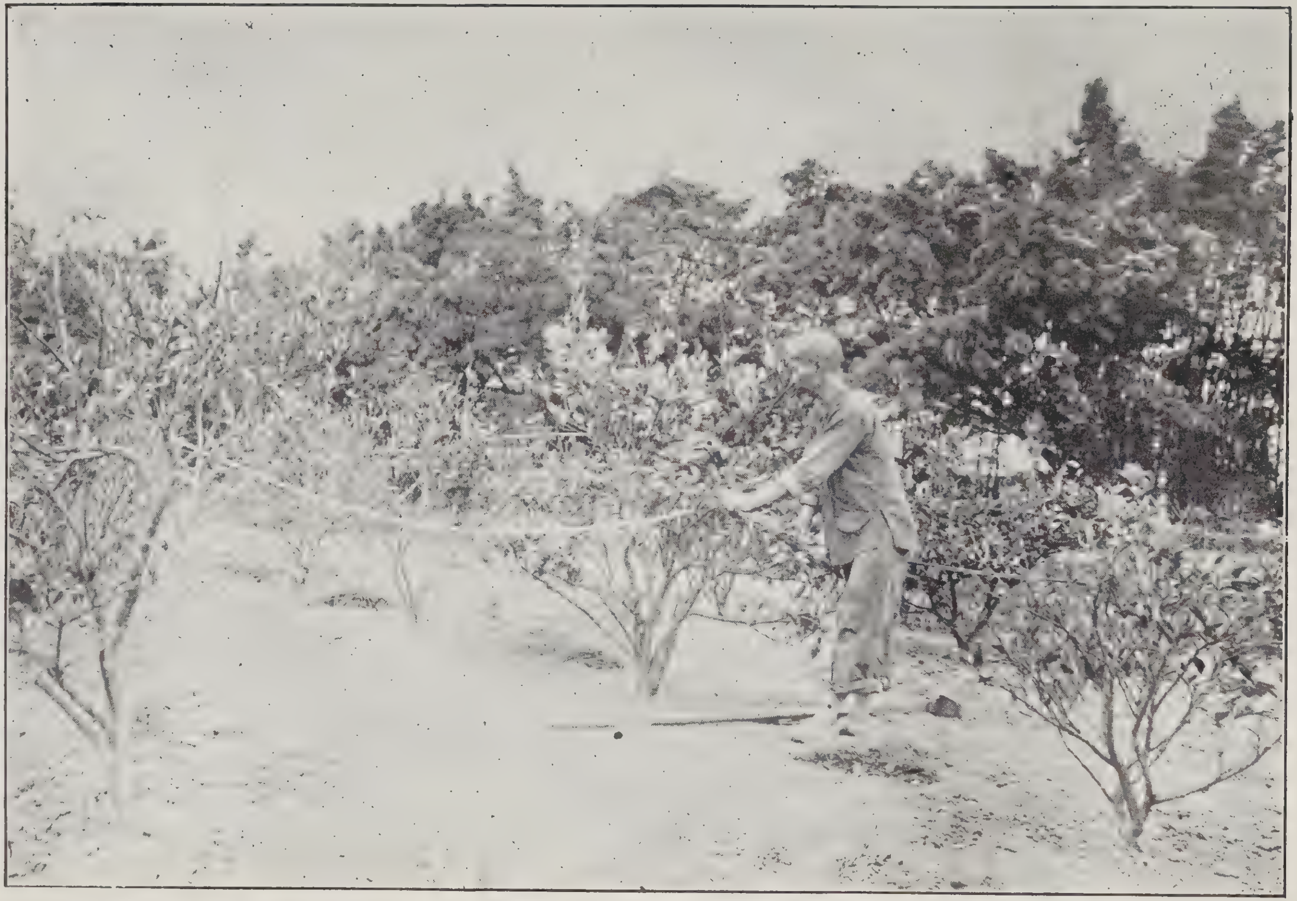

Fig. 1. Chinese orange grower cultivating the citrus ant on the Ling Nan Agricultural College farm. Note the bamboo bridges which have been built to encourage the ants to travel from tree to tree. See page 108.

Plate 1

cultivation of the trees or in working the orchard. During the early months of the year they claim that there is not sufficient food for the ants, and they therefore, very diligently, prepare dog intestines, *Keu ch' ang* (*kau ch' eung*—狗腸), which prove a special delicacy for the ants. If dog intestines are not available the next best food is silkworm larvae. By means of this kind treatment the ants are encouraged not to leave the trees, and the growers claim that they very seldom find them on the ground.

When we questioned the efficacy of this practice the growers insisted that as long as they have strong colonies in their trees they are never troubled with *Tesseratoma papillosa*, the stink bug insects, known to the Chinese as *Ch'ou p'i tan* (*Ch'au p'i tan*—臭屁蛋), which prove so injurious to lychee and citrus fruits. They also claimed that they keep away boring insects. They said that when other insects come to eat the flowers or fruit these ants quickly attack them. They had found by actual experince that when they do not have these nests in the trees very few fruits form and those that do drop to the ground or develop with blemish. Throughout our studies in these groves we learned that these ants are capable of making it very uncomfortable for humans. Their bite is most effective. We considered it very fortunate for the pickers that, as the growers pointed out, the weather at the time of harvest is so cold that the ants do not leave the nests at this time.

The practice of the culture of this ant is also quite widely followed in certain sections of P'unu district (番禺). In the famous fruit region of Lokong (羅岡) they are found thriving in the wild on Chinese olive trees (*Canarium sp.*) and on bamboo. This region, quite accessible in times of peace, is northeast of Canton City. It is easily reached by rail from Canton over the Canton Kowloon Railway and a narrow-gauge branch line running northward from Namkong (南岡). The area is well favored and widely known for its fruit production. A few years ago, before the unsettled conditions existing in the country, it was a favorite resort of the Chinese, especially in early spring when the *mei* (*mui*—梅) *Prunus mume* S. & Z. is in flower. In the Lokong area these ants are known as "fear ants", *ching i* (*king ngai*—驚蟻) or "large yellow ants", *ta huang ngai* (*tai wong ngai*—大黃蟻). Although the growers at Saisha in Szewui claimed their ants could not endure the winter freeze, in Lokong the people did not experience this difficulty. Szewui is doubtless colder than Lokong. In the latter region the growers reported that in the twelfth month, when the weather becomes cold, the ants all return to the nests and will not emerge again until spring. This is the time for picking the nests in the wild and later they are sold to fruit growers for from fifty cents to one dollar each. The Lokong people also claimed that the ants must be carefully observed and when found to be hungry must promptly be fed. This keeps them satisfied to remain in the trees and not to go to the ground to hunt food, as they do when in the wild.

Our observations were that these ants are about twelve to fifteen millimeters in length and of a light brown color. Their small black eyes are very active and they move very rapidly. Their bite is very painful to man and they will attack if teased. Their most interesting habit is that of weaving from the leaves of the trees their most remarkable, silk-structured nests. This habit they share with certain species of *Camponatus* and *Polyrhacis.** The nest is made by drawing together the leaves of the tree in which the ants have chosen to live. Often the nest is formed of a mass of leaves joined into a more or less regular sphere, at least eight to ten inches in diameter. The leaves are drawn together and held by the worker ants while a second set brings up nearly mature larval ants, which they hold in their jaws and move back and forth from one leaf edge to another, until the larva has spun a mass of silk which holds the two leaves firmly together. This process of spinning can be easily observed.

Wheeler gives a very full account of this habit, quoting from many observers. He pictures, after Doflein, a bridge of *Oecophylla smaragdina* workers drawing edges of leaves together while other workers bind them together with the silk spun by the larvae. He also pictures an individual worker using a larva as a shuttle in weaving the silken tissue of the nest. Wheeler translates from Doflein, who, on opening a nest of these ants for the purpose of studying its reconstruction, observed the following phenomena:

> "While the majority of the workers betook themselves to defending their home, a small troop went to work to repair the rent I had made in its wall. They lined up in a very peculiar manner in a straight row as shown in the figure. They seized the edge of the leaf on one side of the rent while they fastened themselves by means of the claws on their six feet to the surface of another leaf. Then they began to pull, slowly and cautiously, carefully placing one foot behind the other, while the edges of the rent were seen gradually to approach each other. It was a bizarre sight to see the animals thus working side by side with their bodies in a regular parallel series.
>
> "Now others came and began to cut away very carefully the remnants of the old web along the edges of the rent. They bit through the web with their mandibles and tugged at it till it came away in shreds. These shreds they carried off in their mandibles to an exposed part of the nest and let them fly away in the wind, opening their mandibles whenever there was a gust. I also saw a whole row of ants carry a big piece of web to the tip of a leaf, open their mandibles as if at command, and permit the piece to flutter away.
>
> "These operations lasted nearly an hour when suddenly a strong gust of wind tore the edges of the rent out of the ants' mandibles and frustrated all their efforts. But the ants were not discouraged. Again a long row of them lined up along the slit and in half an hour they had again brought the edges pretty close together.
>
> "I was about to despair of seeing the important part of the performance, when several workers emerged from the interior of the nest, each with a larva in its mandibles. And they did not run away with the larvae in order to deposit them in a place of safety, but came right up to the exposed opening of the slit. There they were to be seen climbing about behind the row of workers making very odd motions with their heads. With their mandibles they held their larvae so tightly that the bodies of the latter appeared to be compressed in the middle. Perhaps this pressure is necessary in order to excite the function of the spinning glands. It was a strange site to see them passing between the ranks of the workers that were holding the leaves. While the latter remained on the outside, the former carried on their work within the nest. This made it more difficult to observe what was going on. But after some time I could see very clearly that the larvae were carried with their anterior ends directed forward and upward and were kept moving from one side to the other of the rent. At the same time each worker waited an

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* Mr. Gist Gee's list of Chinese ants includes species of both of these genera. Local observations on nest making habits would be of great interest.

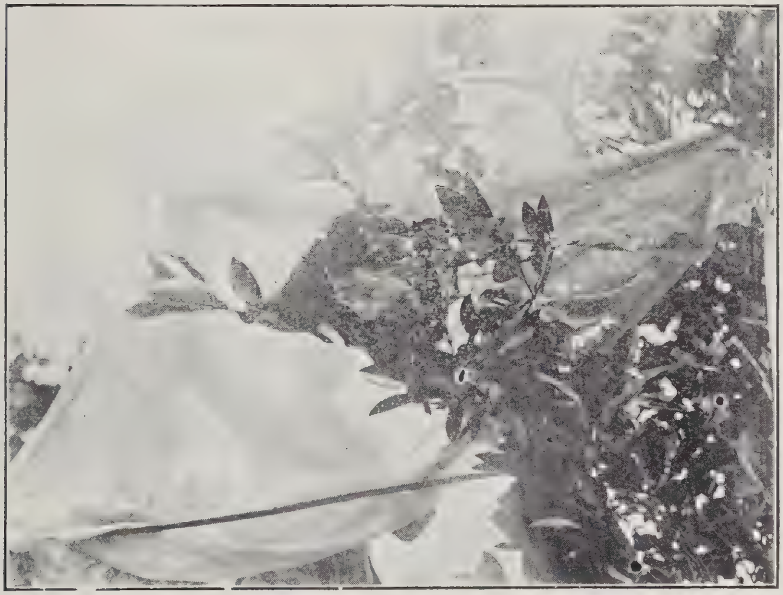

Fig. 2. A strong colony of the cultured ant, *Oecophylla smaragdina* Fabr. in a Szewui mandarin orange tree.

Fig. 3. The crutch of a Szewui mandarin orange tree, showing the red tree ants feeding upon silkworm larvae. See page 169.

Plate 2

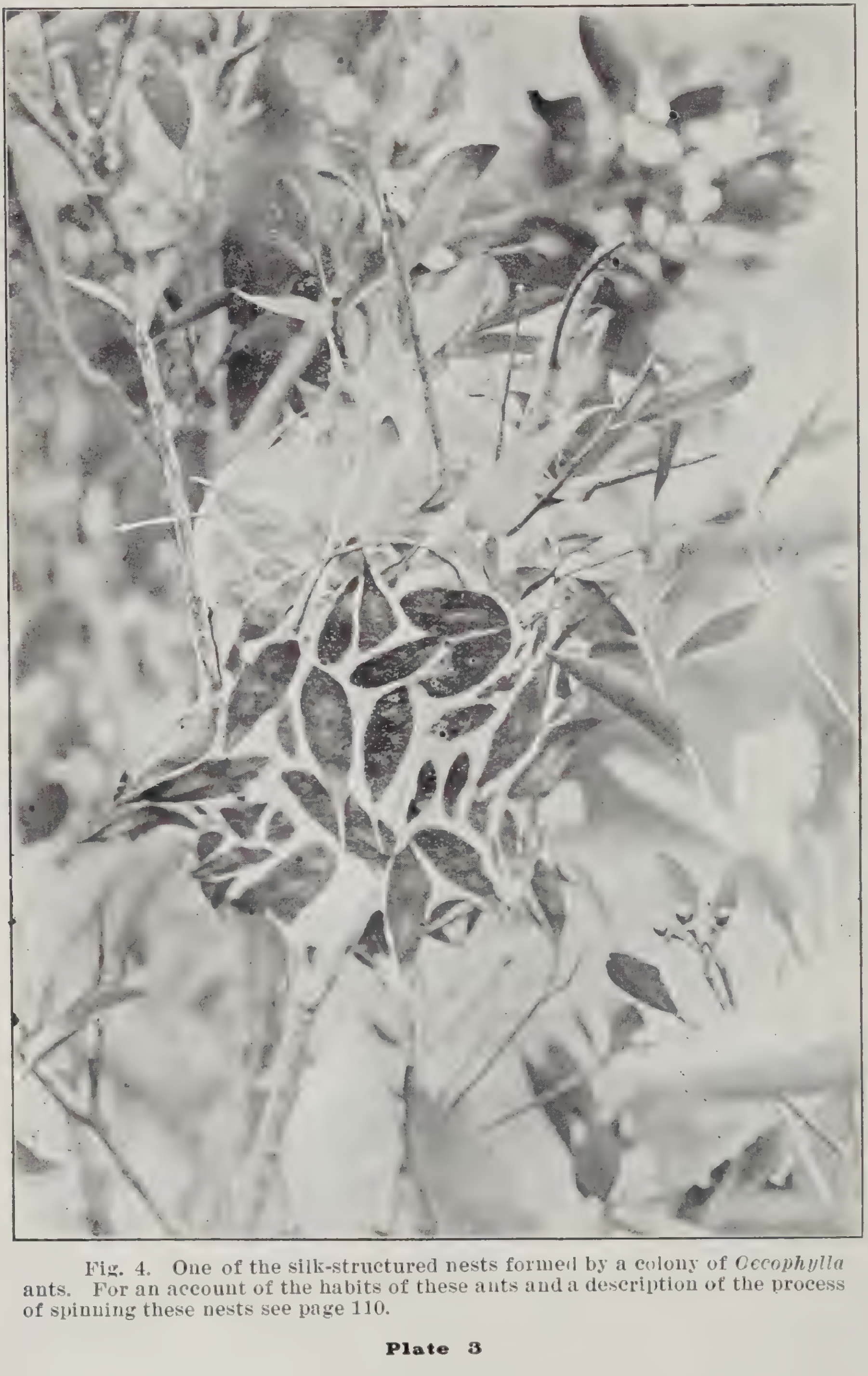

Fig. 4. One of the silk-structured nests formed by a colony of *Oecophylla* ants. For an account of the habits of these ants and a description of the process of spinning these nests see page 110.

Plate 3

instant on one side of the rent, as if it were gluing fast the thread spun by the larva by pressing its head against the leaf, before the head of the larva was carried across the rent and the same process repeated on the other side. Gradually, while they tirelessly pursued their task, the rent was seen to be filled out with a fine, silken web.

"There could be no doubt that the ants were actually using their larvae both as spools and shuttles. As several workers toiled close together, they were able to cross and re-cross the threads and thus produce a rather tenacious tissue. This could be cut with the scissors and the small pieces presented a singular appearance under the microscope. A lot of threads were seen crossing one another and in some places a number of the threads had a common direction. This agrees very well with my observations on the origin of the web. The ants are in the habit of moving to and fro with the larvae many times in the same place before changing their position and running the thread crosswise. In this way strands are soon formed on the outside of the web and evidently save labor on the part of the ants that are holding the leaves together. Under the miscroscope the threads appear to be glued together at many points. This condition is very easily explained when we consider that each thread is moist and sticky for a few moments after leaving the sericteries of the larva.

"I was unable to see the thread itself while it was being spun as it is too delicate and transparent to be visible to the unaided eye. I tried to see it with a strong lens, but in a twinkling dozens of ants had covered my eyelids and after brushing them away I was only too glad to be able to see at all."

Wheeler also quotes from Dodd's account of the nest-building habits of *Oecophylla virescens* in Queensland: "It is decidedly interesting to observe the insects engaged upon the construction of their domiciles. If the foliage is large or stiff, scores or even hundreds of the ants may be required to haul a leaf down and detain it in place until secured, both operations taking considerable time. It is quite a tug-of-war matter to bring the leaf into position and keep it there. The insects holding it have a chain of two or three of their comrades fastened on to them, one behind the other, each holding its neighbor by its slender waist, and all at full stretch and pulling most earnestly. What a strain it must be for poor number one! When the leaf is far apart the ants form themselves into chains to bridge the distance and bring it down; many of these chains are frequently required for a single leaf. I have seen a large colony at work upon a new nest, and several of these chains were from three to four inches long; altogether there were many of them in evidence, some perpendicular, others horizontal. Up or along these living bridges other ants were passing.

"Now for the web material used to build the nests. It is furnished in fine and delicate threads by the larvae; moreover, I have only seen what appears to be half-grown examples used for the work—I have never seen a large larva being made use of. The soft and tiny grubs are held by the larger ants, who slowly move up against those pulling. Each grub is held by the middle, with head pointing forward, its snout is gently made to touch the edges of the leaves where they are joined, it is slowly moved backwards and forwards and is undoubtedly issuing a thread during the operation, which adheres to the leaf edges, and eventually grows into the web. When this web is completed it must be composed of several layers to be strong enough for the purpose of securing the leaves. Whether the larva is an unwilling instrument or not in its captor's mandibles is a point which cannot be ascertained. Maybe it is, for it cannot be comfortable in such a position. However, it supplies the web; perhaps if it were not robbed of the web for the benefit of the community it would be able to spin a cocoon for itself, in which to undergo the delicate change into the pupa state, for I have never seen a cocoon, all pupae being quite naked.

"When contemplating the work done in these nests one cannot but marvel at the wonderful ingenuity displayed, or in endeavouring to form some idea of the vast number of larvae which must be utilized to supply the connecting web even for a moderately sized nest, for with trees with narrow leaves, like *Eucalpytus tesselaris* for instance, many scores of leaves are required to form a nest, and each must be sewn."

In order more accurately to determine what is the true relationship of these insects to citrus trees and their insect fauna several nests were secured and taken to the campus of the Canton Christian College where it was possible to watch them more closely, both in cages and in citrus trees. When placed in citrus trees, the trunk was ringed with grease to prevent their escape. Then each tree was connected with several other trees by bamboo bridges, in native fashion. The trunk of each tree thus connected was also ringed with grease. As soon as the nest was introduced the ants at once raided the entire range provided for them and drove out every other ant such as *Dolichoderus taprobanae*, which makes its nests also in the leaves of the citrus trees. These ants were seized in the jaws and held high above the leaf until dead and then dropped. All caterpillars were also attacked and killed except those covered with hair. Larvae of *Papilio demoleus* were seized at ends and side by several of the *Oecophylla* and stretched taut and held in that way motionless for as long as an hour, or at least until they were dead. As soon as dead each caterpillar was dragged into the nest, apparently to be eaten. In eating the caterpillars holes are cut through the skin and the blood is sucked up greedily. This method of attacking caterpillars seemed to be the usual custom. Adult insects, if small enough, such as flies, are seized in the mandibles and held above the ant's body until dead, or until help comes to despatch them. If adult insects are very large they are seized by several ants and stretched until dead. This happened with such insects as large wasps, which died from such treatment within half an hour.

Pieces of meat were carried into the nest for food. Sugar was eaten when placed near the nest.

When a branch of citrus covered with aphids was placed in the tree near a nest, the ants first showed anger at the moving of the bodies of the aphids, then seized them in their jaws, and dropped them off the trees. They never seemed to tend the aphids but colonies of soft-scales were carefully tended and their excretions eaten. One observation seemed to indicate that aphids may be preserved by the ants under some circumstances.

Every variety of ant which invaded the citrus trees or attempted to build nests in the leaves of the tree was exterminated by these Oecophyllas. They have a good means of protection against enemies, for when they are roughly handled or frightened the abdomen is raised and a drop of acid-like fluid is emitted freely from the anus, so forcibly that it may be thrown several inches.

The real economic value of these ants is questionable. The idea of their usefulness would seem to have grown up from their destruction of caterpillars and other large insects. But they obviously do not destroy the scale insects and not always the plant lice, which are also serious enemies of citrus trees. In fact the leaves included in the nest of the ants themselves are usually full of soft-scales. Like many other observations of the untrained man, they seem to have been incomplete although correct as far as they have gone.

We have not noted many references to these cultured ants of South China in western literature and the Chinese references that have come to our attention are very brief. In the *Chinese Encyclopedia of Ancient and Modern Times* it is recorded that at a certain time when very few fruits seemed to form on mandarin orange trees of the Lofau (羅浮) country it was noted that a certain ant common to the Ling Nan (嶺南) region, and larger than the "horse ant", *ma i* (*ma ngai*—馬蟻), formed their nests on these orange trees. Later it was discovered that sometimes fruits with thin and smooth skin could be found enclosed within the nests of these ants and that when these were removed during the winter months the flavor was several times superior to the ordinary fruits. At another place in this same work it is recorded that in the region of Canton the people grow many kumquat, *Fortunella sp.*, but in many places the ravages of insects are very serious. However, if there are colonies of a certain kind of ant on the trees then other insects will not harm the trees. In practising this art the lard of either the pig or sheep is placed near the nest and after the ants have entered it they are carried away for culture in the orange trees. And this is called *raising the mandarin orange ant*, (養柑蟻). Lai Ch'ang (賴昌), in the Complete Book of Agricultural Administration (農政全書), corroborates this general information that when the mandarin oranges are attacked by insects the latter are easily driven away by placing ant nests in the trees. In Pei Wan Chai's (佩文齋) work, *Kwang Ch'un Fang P'u* (廣群芳譜), it is claimed that the kumquat is attacked by a "black ant", *hei i* (*ha ngai*—黑蟻) and in order to combat them the people purchase "yellow ants", *huang i* (*wong ngai*—黃蟻) which they place in the trees. The "yellow ants" attack the "black ants" and kill them and the trees thrive thereafter.

It is interesting that this practice should be continued to the present day in these parts of China. The advantages of the practice have not been scientifically established. The late Mr. Kwok Wah Shau (郭華秀), one of [illegible] investigators, claimed that the people he interviewed always regarded th[illegible]actice as be[illegible]nd insisted that these ants did control what they ca[illegible]a ch'ung [illegible]—蚜蟲).

References

1. Wheeler, William Morton,
Ants, their structure, development and behavior, New York, The Columbia University Press, 1910, pages 218-221.

2. Ku Chin T'u Shu Chi Cheng (古今圖書集成), Po Wu Hui Pien (博物彙編), Ts'ao Muh Tien (草木典), Section 226 (二百二十六卷) Chin P'u (柑部).

a. Note No. 3 and 4 (紀事之三之四).

b. Note No. 1 (雜錄之一).

3. Lai Ch'ang (賴昌) in Nung Cheng Ch'uan Shu (農政全書) Chapter 30 (第三十卷), Tree culture (樹藝), page 39 (第三十九卷).

4. Pei Wen Chai (佩文齋), 1708, in Kuang Ch'un Fang P'u (廣群芳譜), Fruit Book 11 (果部十一) Chu, page 21 (橘第廿一頁).

AN ENUMERATION OF THE McCLURE COLLECTION OF HAINAN PLANTS*

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Canton Christian College

187—Guttiferae

187.5169—CRATOXYLON LIGUSTRINUM (Spach) Blume
(C. POLYANTHUM Korth)

Near Tiu Li (?), 7688, Oct. 28, 1921, *Tai Tsing* (大井), 7780, Oct. 24, 1921, *Kam Kong* (金江), 8245, Oct. 26, 1921, *Ting On River* (定安河), 8870, Apr. 6, 1922 and *Hainan, Yik Tsok Mau* (海南 亦作茂), 9740, May 19, 1922; dry roadside among other shrubs, edge of thicket, in waste places among trees, on grassy hillside; alt., 40 m.; bush; ht., 2/3-5 m.; dia., 1-12 cm.; fls., salmon pink; becomes quite a large tree, 7-8 m. high and 15 cm. in dia ; wood is very hard and is used for plow beams; name reported, *Wong ngau muk* (黄牛木).

187.5178—CALOPHYLLUM INOPHYLLUM Linn.

Kingchow (瓊州), 7541, Oct. 14, 1921 and *Hainan, Kachek* (海南,嘉積), 8796, Oct. 14, 1921 and 9777, May 1922; roadside, sandy slopes; tree; ht., 6-9 m.; dia., 20-25 cm.; fls., white, very fragrant; oil pressed from seeds, used as illuminant; tree makes good ornamental; name reported, *Hoi t'ong kwo* (海棠菓).

McClure reports that this tree is cultivated extensively in Eastern Hainan and that the wood is used somewhat in building, but it has a tendency to wharp. He secured an economic specimen of the wood, C. C. C. Ec. No. 156 (McClure Ec. No. 69).

187.5178—CALOPHYLLUM MEMBRANACEUM Gardn.

Five Finger Mt., (五指嶺), 8495, Dec. 23, 1921 and 8655, Dec. 20, 1921; moist shady ravine on rock cliff; alt., 600 m.; shrub; ht., 3 4 m.; dia., 3 cm.; frs., yellow.

187.5199—GARCINIA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 253.

Five Finger Mt., (五指嶺), 9457, May 6, 1922; wooded ravine; tree; ht., 10 m.; dia., 15 cm.; fls., greenish cream, slightly fragrant.

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*This is a continuation of the enumeration of the Hainan collection which appeared in Lingnaam agricultural review, v. 1 (1923), No. 2, pp. 27-86, and v. 2 (1924), No. 1, pp. 9-44.

The reader is also referred to Mr. F. A. McClure's article, Notes on the island of Hainan, in Lingnaam agricultural review, v. 1 (1922), No. 1, pp. 66-79 pl. 5, map.

187.5199—GARCINIA OBLONGIFOLIA Champ.

Ting On River (定安河), 7656, Oct. 14, 1921 and 8928, Apr. 9, 1922, *Hainan, Oo P'o Shun P'o* (海南, ?), 9778, May 1, 1922 and *Five Finger Mt.*, (五指嶺), 9810, May 1, 1922; on bank of river, on half-wooded hill; alt., 70 m.; tree; ht., 7-8 m.; dia., 12-20 cm.; fls., yellow, cream, white, fragrant; frs., edible; names reported, *Shan chuk* (山竹), *Ch'i nga tsai* (黐牙仔), *Nam po lo* (腍波羅).

187.5199—GARCINIA OLIGANTHA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 254.

Five Finger Mt., (五指嶺), 8701, Dec. 20, 1921; in mountain side forest; alt., 700 m.; shrub; ht., 1½ m.

198–Violaceae

198.5271—IONIDIUM SUFFRUTICOSUM (Linn.) Ging.

Ting On River (定安河), 8894, Apr. 7, 1922; sandy waste; alt., 50 m.; fls., deep blue.

198.5274—VIOLA aff. DIFFUSAE Gingn.

Five Finger Mt., (五指嶺), 9536, May 11, 1922; wooded ravine; herb; frs., purple.

198.5274—VIOLA PHILIPPICA Cav. subsp. MALESICA W. Bckr.

Five Finger Mt., Hop Lo Ts'un (五指嶺,合籮村), 8363, Dec. 6, 1921; grassy hillside; alt., 650 m.; herb; fls., blue.

199–Flacourtiaceae

199.5290—TARACTOGENOS HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 255.

Hainan, Shui Mun (海南 水門), 9636, May 15, 1922; on rocky bank of stream; tree; ht., 6 m.; dia., 12 cm.; fls., white when open; open flowers drop very readily.

199.5304—SCOLOPIA CHINENSIS (Lour.) Clos.

Hoihow (海口), 7571, Oct. 12, 1921, *Mi Ting* (美亭), 8234, Oct. 26, 1921; edge of thicket; bush; ht., 2 m.; dia., 8 cm.; frs., red.

199.5313—HOMALIUM HAINANENSIS Gagnep.

Hainan, Yik Tsok Mau (海南,亦作茂), 9749, May 19, 1922; wooded ravine; tree; ht., 15-20 m.; dia., 30-50 cm.; wood very hard, used in building doors and frames, also for coffins; name reported, *Tin liu muk* (天料木).

McClure secured Economic specimen of this wood, C. C. C. Ec. No. 157 (McClure No. 88).

199.5320—XYLOSMA CONTROVERSUM Clos.

Five Finger Mt., (五指嶺), 8526, Dec. 18, 1921, *Hainan, Fan Ya* (海南,番也), 9512, May 9, 1922 and *Fan Ya, Yik Tsok Mau* (番也至亦作茂), 9662, May 17, 1922; edge of rice field on grassy hillside; alt., 600 m.; tree; ht., 2½ 5 m.; dia., 5-7 cm.; frs., berries red.

199.5327—FLACOURTIA RUKAM Z. & M.

Five Finger Mt., (五指嶺), 8681, Dec. 21, 1921; wooded ravine; alt., 650 m.; tree; ht., 10 m.; dia., 15 cm.; frs., edible.

199.5343—CASEARIA GLOMERATA Roxb.

Kingchow (瓊州), 7621, Oct. 14, 1921 and *Tai Tsing* (大井), 7750, Oct. 24, 1921; roadside; ht., 1 m.; frs., orange when ripe.

199.5343—CASEARIA VILLILIMBA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 254.

Nodoa, Sha Po Ling (那大,沙煲嶺), 8160, Nov. 11, 1921 and *Five Finger Mt.*, (五指嶺), 9326, Apr. 28, 1922; wooded hillside, on rock in deep shady moist ravine; alt., 450 m.; tree; ht., 4-7 m.; dia., 8 to 10 cm.; fls., orange yellow.

199.5343 CASEARIA SP.

Five Finger Mt., (五指嶺), 8485, Dec. 23, 1921; wooded ravine; alt., 800 m.; bush; ht., 1 m.; frs., yellow.

203—Passifloraceae

203.5370—ADENIA MACLUREI Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 349.

Near Notia (近和舍), 8242, Oct. 27, 1921; climbing on shrubs; vine; frs., pod, red; seeds, black.

203.5372—PASSIFLORA LIGULIFOLIA Mast.

Hainan, enroute T'a Hon, to Nga Wan (海南.他寒之道側.牙環), 9251, 9285b,** Apr. 22, 1922 and *Hainan, near Fan Ya* (海南,近番也), 9285a, Apr. 25, 1922 and *Hainan, near Fan Ya* (海南 近番也), 9514, May 9, 1922; hillside on shrubs; in ravine; vine; ht., 2-4 m.; fls, white.

208—Begoniaceae

208.5397—BEGONIA LACINIATA Roxb.

Hainan, near summit of Five Finger Mt., (海南,近五指嶺), 9396, May 1, 1922; moist shady nook on rocky cliff; herb; ht., 1 m.; fls., pink.

208.5397—BEGONIA sp.

Five Finger Mt., (五指嶺), 9325 Apr. 28, 1922; on wet, rock wall; in deep shaded nook; herb; ht., 1½ m.; fls., white, nodes and base of plant very large.

209—Ancistrocladaceae

209.5400—ANCISTROCLADUS EXTENSUS Wall.
(A. HAINANENSIS Hayata)

Tai Un, Hainan (大圓.海南), 7685, Oct. 26, 1921 and *Five Finger Mt.*, (五指嶺), 8652, Dec. 20, 1921 and *Hainan, West of Tai Wan, San Hu* (海南.大環之西.新墟), 8954, Apr. 10, 1922 and *Hainan, Yik Tsok Mau* (海南 亦作茂), 9828, May 19, 1922; dry roadside, moist shady ravine on tree; in shrubby waste land; alt., 600 m.; vine; ht., 2-4 m.; dia., 2 cm.; fls., white, yellow, green.

** Sufficient material for only one specimen was collected of all numbers marked ** and this one will be found in the Philippine Bureau of Science.

210–Cactaceae

210.5417—OPUNTIA SP.

Hoihow (海口), 7657, Oct. 10, 1921; name reported, *Sin yan cheung* (仙人掌).

210. ? HYDROCEREUS UNDATUS (Haw.) Britton & Rose

Ooi Diok, Hainan (? ,海南), 8781, Oct. 16, 1921; on wall at edge of village, in dry places; herb; fls., light yellowish white; name reported, *Pa wong ping* (霸王鞭).

214–Thymelaeaceae

214.5430—AQUILARIA SINENSIS (Lour.) Merr.

Hainan, enroute Kachek-Wong Chuk (海南,嘉積之道側, ?), 9789, June 1, 1922; in thicket at roadside; tree; ht., 5-6 m., dia., 15 cm.; bark used in making paper; the center part of the tree called "Cham heung" (沈香) and is burned for its fragrance; name reported, *Heung ma* (香蔴).

214.5446—WIKSTROEMIA INDICA (Linn.) C. A. Mey.

Hoihow (海口), 7597, Oct. 10, 1921; on grass; bush; ht., 1 m.; fls., greenish; name reported, *Liu ko wong* (了哥王).

215–Elaeagnaceae

215.5472—ELAEAGNUS GAUDICHAUDIANA Schlecht.

Five Finger Mt., (五指嶺), 8608, Dec. 26, 1921; open hillside; shrub; ht., 2½ m.; fls., whitish.

216–Lythraceae

216.5473—ROTALA ROTUNDIFOLIA (Roxb.) Kothne.

Hainan, near T'a Hon (海南,近咃寒), 9223, Apr. 21, 1922; edge of rice fields; herb; fls., lavender; name reported, *Sai* (皆).

226.5493—LAGERSTROEMIA INDICA Linn.

Kingchow (瓊州), 7622, Oct. 14, 1921; dry thicket; vine; ht., 2/3 m.; fls., pink; name reported, *Tsz mi fa* (紫薇花).

216.5493—LAGERSTROEMIA SP. (TRICHOCARPIDIUM.)

Ka La (加拉), 8325, Dec. 4, 1921; edge of stream; alt., 350 m.; tree; ht., 5 m.; dia., 15 cm.

216.5494—LAWSONIA INERMIS Linn.

Hoihow (海口), 7614, Oct. 9, 1921; dry land; bush; ht., 2 m.; dia., 6 cm.; fls., yellowish white, fragrant; name reported, *Chi kap fa* (指甲花).

220–Rhizophoraceae

220.5525—CARALLIA BRACHIATA (Lour.) Merr.

Nodoa, Lin Fa Ling (那大.蓮花嶺), 8051, Nov. 2, 1921; thicket; alt., 450 m.; shrub; ht., 3 m.; fls., greenish.

221—Combretaceae

221.5538—COMBRETUM PILOSUM Roxb.

Hainan, S. of Fan Ta (海南,番打之南部), 9160, Apr. 19, 1922: on shrubby hill land; shrub; ht., 1½-2 m.; fls., brown.

221.5544—TERMINALIA CATAPPA Linn.

Hainan, Kachek (海南,嘉積), 9826, June 1, 1922; in Mission Compound; tree; ht., 7 m.; dia., 30 cm.; fls., yellowish white, fragrant; name reported, *P'i p'a shu* (批把樹).

222—Myrtaceae

222.5559—PSIDIUM GUAJAVA Linn.

Ka La (加拉), 8330, Dec. 4, 1921 and *Hainan, near T'a Hon* (海南,近吔寒), 9221, Apr. 21, 1922; roadside, along stream; alt., 250 m.; tree; ht., 3-5 m.; dia., 9 cm.; fls., white, fragrant; frs., edible; names reported, *Fan shek lau* (番石榴), *Shek lau* (石榴).

222.5562—DECASPERMUM FRUTICOSUM Forst.

Five Finger Mt., (五指嶺), 8628, Dec. 21, 1921 and *Hainan, S. of Ka La* (海南,加拉之南部), 9208, Apr. 21, 1922 and *Hainan, enroute T'a Hon to Nga Wan* (海南,吔寒至牙環之道側), 9247, Apr. 22, 1922 and *Hainan, near Fan Ya* (海南,近番也), 9629, May 15, 1922, 9631 May 15, 1922; along stream, hillside, among shrubs, open ravine; alt., 600 m.; shrub; ht., 2-3 m.; dia., 1-1½ cm.; fls., white, fragrant; name reported, *Tsz lin shu* (子楝樹).

222.5563—RHODOMYRTUS TOMENTOSA (Ait.) Hassk.

Mi ting (美亭), 7745, Oct. 26, 1921 and *Nam Fung* (南風), 8264, Dec. 2, 1921 and *Hainan, Kingchow* (海南,瓊州), 8839, Apr. 5, 1922 and *Hainan, W. of Tai Wan, San Hu* (海南,大環之西部,新墟), 8952, Apr. 10, 1922; grassy hillside, in shrubby waste land; alt, 10-300 m.; bush; ht., 1-2 m.; fls., pink, white; frs., edible; names reported, *Shan nim* (山棯), *Kong nim tsai* (江棯仔), *Pak fa kong nim* (白花江棯), *Kong nim* (江棯), *Nim tsai* (棯仔).

222.5578—EUGENIA CUMINI (Linn.) Druce.
(E. JAMBOLANA Lam.)

Notia (和舍), 7787, Oct. 27, 1921 and *Hainan, W. of Tai Wan, San Hu* (海南,大環之西部,新墟), 8945, Apr. 10, 1922 and *Hainan, enroute Sai Ching, T'a Hon* (海南,西正至他寒之道側), 9811, May 20, 1922; roadside, in dry rolling countryside, on open hillside; tree; ht., 6-12 m.; dia., 20-45 cm.: fls., white, fragrant; frs., dark red when ripe; the wood of this tree is used in the construction of houses and is considered very good; names reported, *Tsz lin shu* (子楝樹), *U muk* (烏木).

222.5578—EUGENIA FLUVIATILIS Hemsl.

Pat Ka Ling (筆架嶺), 7725, Nov. 1, 1921 and *Hainan, near Shui Mun* (海南近水門), 9617, May 15, 1922; edge of thicket, on rocks at edge of stream; shrub; ht., 1/3-2 m.; fls., white; frs., black.

222.5578—EUGENIA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 255.

Hainan, Yik Tsok Mau (海南,亦作茂), 9734, May 19, 1922; in wooded ravine; tree; ht., 25 m.; dia., 60 cm.; fls., white with pink stamens.

222.5578—EUGENIA HENRYI Hance.

Tai Un (大圍), 7828, Oct. 26, 1921; edge of thicket; bush; ht., 13 m.; frs., white; name reported, *To ti kwat* (灶地骨).

222.5578—EUGENIA JAMBOS Linn.

Hainan, South of Fan Ta (海南,番打之南), 9156, Apr. 19, 1922; edge of stream; tree; ht., 7 m.; dia., 10 cm.; fls., white; frs., edible; name reported, *Shui p'o t'o* (水葡桃).

222.5578—EUGENIA MACLUREI Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 350.

Tai Un (大圍), 7678, Oct. 26, 1921; thicket; shrub; ht., 2 m.; fls., white, fragrant.

222.5578—EUGENIA MYRSINIFOLIA Hance.

Nga Wan (牙環), 8347, Dec. 6, 1921 and *Five Finger Mt.*, (五指嶺). 8525, Dec. 18, 1921 and *Hainan, near Shui Mun* (海南,近水門), 9637, May 15, 1922; shady moist ravine, edge of mt. stream; alt., 600-650 m.; shrub; ht., 2-3 m.; fls., white; frs. blackish red when ripe.

222.5578—EUGENIA SALIGNA (Miq.) C. B. Rob.
(E. ACUMINATISSIMA Kurz)

Five Finger Mt., (五指嶺), 8682, Dec. 21, 1921; mt. side forest; alt., 750 m.; ht., 1½ m.

222.5578—EUGENIA SP.

Five Finger Mt., (五指嶺), 8425, Dec. 9, 1921, 9420, May 4, 1922, 9444a, May 5, 1922 and *Hainan, Nodoa* (海南,那大), 8992, Apr. 12, 1922; wooded ravine on tree, in lawn; alt., 1000 m.; tree; vine; ht., 3-15 m.; dia., 2-45 cm.; frs., red; name reported, *Sha lo shu* (沙羅樹).

223—Melastomataceae

223.5650—MELASTOMA DECEMFIDUM Roxb.
(M. SANGUINEUM Sims.)

Pat Ka Ling, Nodoa (筆架嶺,那大), 8042, Nov. 1, 1921 and *Mi Ting* (美亭), 8235, Oct. 26, 1921; dry, open shrubby places; thicket; shrub; ht., 1½-3 m.; fls., pink.

223.5650—MELASTOMA SEPTEMNERVIUM Lour
(M. CANDIDUM Don.)

Pat Ka Ling (筆架嶺), 8028, Nov. 1, 1921, *Hainan, S. slope of Five Finger Mt.*, (海南,五指嶺之南麓), 9410, May 3, 1922 and *Hainan, near Nam Fung* (海南,近南風), 9822, Apr 15, 1922; dry, open grassy places, in heavily wooded ravine; among shrubs in waste places; alt., 250 m.; shrub; ht., 1-2½ m.; dia., 1½-2 cm.; fls., pink; frs., very hairy; leaves pounded into a mush and fed to pigs as roughage; names reported, *Nim fa* (棯花), *Mo nim* (毛棯), *Chu ku nim* (猪骨棯), *Kai t'au kwo* (雞頭菓).

223.5658—OSBECKIA CHINENSIS Linn.

Hainan, near Fan Ta (海南,近番打), 7826**, and 7757**, 9147, Apr. 18, 1922; in dry grassy place at roadside; bush; dia., 30-40 cm.; names reported, *Chong tin ung* (裝天甕), *Tin heung lo* (天香爐).

223.5703—BLASTUS COCHINCHINENSIS Lour.

Nodoa, Sha Po Ling (那大,沙煲嶺), 8134, Nov. 10, 1921, *Hainan, near cave, S. slope of Five Finger Mt.*, (海南,近穴,五指嶺之南麓), 9356, Apr. 29, 1922 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9693, May 18, 1922; in thicket on mt. top, on moist rock in wooded ravine, among undergrowth in wooded ravine; shrub; ht., 1-2 m.; dia., 1-1½ cm.; fls., white; frs., pods only.

223.5729—SONERILA CANTONENSIS Stapf.

Five Finger Mt., Fan Ya (五指嶺番也), 8409, Dec. 1921 and *Hainan* (海南), 9329, Apr. 28, 1922; wooded mt. side in rich soil; alt., 800 m.; herb; dia., 15-20 cm.; fls., pink; leaves red on under surface.

223.5729—SONERILA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 256.

Hainan, near summit of Five Finger Mt., (海南,五指嶺之山頂), 9391, May 1, 1922; near summit in thicket and in rich soil; bush; fls., pink.

223.5788—MEMECYLON LIGUSTRIFOLIUM Champ.

Tai Un (大園), 7740, Oct. 26, 1921, *Nodoa* (那大), 7946, Nov. 9, 1921, *Hainan, W. of Tai Wan, San Hu* (海南,大環之西部,新墟), 8943, Apr. 10, 1922 and *Hainan, S. slope of Five Finger Mt.*, (海南,五指嶺之南麓), 9411, May 3, 1922; dry, rolling grassy plain, roadside, in shrubby waste land, in heavily wooded ravine; alt., 250 m.; shrub; ht., 1-2½ m.; dia., 2-2½ cm.; fls., blue, purple, pink; names reported, *Kok muk shu* (角木樹), *Tsz lin shu* (子楝樹).

224—Oenotheraceae

224.5791—JUSSIAEA ERECTA Linn.
(J. SUFFRUTICOSA auct. plur., non L.)

Nodoa (那大), 7735, Oct. 31, 1921 and *Hainan, W. of Tai Wan, San Hu* (海南,大環之西部,新墟), 8958, Apr. 10, 1922; in moist soil near stream, moist roadside; bush; ht., 1/3-1½ m.; fls., yellow; names reported, *Ka wong che* (假黃車), *Ka tsiu* (假焦).

224.5791—JUSSIAEA REPENS Linn.

Kingchow (瓊州), 7647, Oct. 14, 1921 and *Enroute T'a Hon, Nga Wan* (咃寒道邊,牙環), 9232, Apr. 22, 1922; edge of wet field, in idle rice paddy; herb; fls., white with yellow center.

224.5793—LUDWIGIA PROSTRATA Roxb.

Nodoa, Ha Kung Ling (那大,蝦公嶺), 8222, Nov. 21, 1921; near hot spring; alt., 300 m.; fls., yellow.

227—Araliaceae

227.5852—SCHEFFLERA OCTOPHYLLA (Lour.) Harms.

On Yan (安仁), 7894, Oct. 26, 1921; village commons; alt., 250 m.; tree; ht., 10 m.; dia., 30 cm., fls., white.

227.5852—SCHEFFLERA ARBARICOLA (Hay.) Merr.

Hainan, near Shui Mun (海南.近水門), 9596a, and 9596b, May 14, 1922; on open hillside, growing in trunk of dead tree; shrubby vine; ht., 2 m; fls., white; the sap gives forth a pungent odor when the branches are broken.

227.5857—BRASSAIOPSIS GLOMERATA O. Ktz.

Hainan, S. slope of Five Finger Mt., (海南,五指嶺之南麓), 9434, May 4, 1922.

227.5868—ACANTHOPANAX TRIFOLIOLATUM (Linn.) Merr.

Hoihow, Hainan (海口,海南), 7544, Oct. 14, 1921; thicket; bush; fls., white.

227.5881—ARALIA DASYPHYLLA Miq.

Pat Ka Ling, Nodoa (筆架嶺.那大), 8044, Nov. 1, 1921; moist wooded ravine; tree; ht, 5 m.; dia., 10 cm.; fls., white; name reported, U *a pat ki* (烏鴉不企).

227.5881—ARALIA SP.

Five Finger Mt., Yik Tsok Mau Ts'un (五指嶺,亦作茂村), 8474, Dec. 1921; wooded ravine; alt., 600 m.

228—Umbelliferae

228 5893--HYDROCOTYLE JAVANICA Thunb.

Five Finger Mt., Fan Ya Ts'un (五指嶺.番也村), 8431, Dec. 8, 1921, *Five Finger Mt.*. (五指嶺). 8521, Dec. 22, 1921 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9657, May 17, 1922; village commons, wooded ravine, among grass in swamp along stream; alt, 600 to 950 m.; herb; fls., yellowish white.

228.5923—ERYNGIUM FOETIDUM Linn.

Five Finger Mt., Hop Lo Ts'un (五指嶺,合羅村), 8359, Dec. 6, 1921 and *Hainan, roadside* (海南,道邊). 9217, Apr. 21, 1922; roadside near village; alt., 800 m.; herb; dia., 15-20 cm.; fls, yellowish green; names reported, *Lak un sai* (竻芫茜), *Yeung un sai* (洋圓茜).

228.6062—FOENICULUM VULGARE Gaertn.

Hainan, Nga Wan (海南,牙環), 9272, Apr. 23, 1922 and *Hainan, near Fan Ya* (海南.近番也), 9607, May 14, 1922; cultivated in garden; herb; ht., 1 m.; fls., yellow; names reported, *Un sai* (芫茜), *Ts'ing un sai* (青芫茜).

228.6070—SELINUM MONNIERI Linn.

Hainan, Kingchow (海南,瓊州), 8842, Apr. 5, 1922; grassy, shady habitat; alt., 10 m.; ht., 1 m.; fls., white; name reported, *Ka kan ts'oi* (假芹菜).

229—Cornaceae

229.6154—ALANGIUM CHINENSE (Lour.) Rehd.
(A. BEGONIIFOLIUM) Baill.

Hainan, near Ting On River (海南,定安河), 8863, Apr. 6, 1922 and *Hainan, above cave, S. slope of Five Finger Mt.*, (海南.穴上,五指嶺之南麓), 9358, Apr. 29, 1922; on sandy bank, wooded ravine; tree; ht., 4-30 m.; dia., 8-50 cm.; fls., first cream, then orange to golden yellow, slightly fragrant; wood very hard; name reported, *Pau tsz shu* (包子樹).

229.6154—ALANGIUM an SP. NOV. Marlea.

Hainan, Kam Kong (海南 金江), 8936, Apr. 8, 1922; on river bank; alt., 70 m.; ht., 8 m.; dia., 30 cm.; frs., edible; name reported, *Kot lo kwo* (割羅菓).

233—Ericaceae

233.6184—RHODODENDRON FORDII Hemsl.

Summit of Five Finger Mt., (五指嶺之山頂), 9378, May 1, 1922; in very loose, mossy soil; shrub; ht., 2 m.; frs., brownish.

233.6200—PIERIS RUBROVENIA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 256.

Hainan, summit of Five Finger Mt., (海南,五指嶺之山頂), 9380, May 1, 1922; in rich, loose, mossy soil; shrub; ht., 2½-3 m.; dia., 6 cm.

233.6216—VACCINIUM SP.

Hainan, summit of Five Finger Mt., (海南 五指嶺之山頂), 9381, May 1, 1922; parasite on pine tree; vine; ht., 5 m.; dia., 4 cm.

236—Myrsinaceae

236.6283—MAESA ACUMINATISSIMA SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 257.

Five Finger Mt., (五指嶺), 8572, Dec. 12, 1921, and 9454, May 5, 1922; in heavily wooded ravine; alt., 1400 m.; shrub; ht., 1½-4 m.; dia., 3 cm.; frs., white, immature.

236.6283—MAESA CONSANGUINEA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 258.

Hainan, S. slope of Five Finger Mt., (海南,五指嶺之南麓), 9468, May 6, 1922 and 9541, May 13, 1922; in wooded ravine; shrub; ht., 1-1½ m.; frs., immature.

236.6283—MAESA SINENSIS A. DC.

Pat Ka Ling, Nodoa (筆架嶺 那大), 8031, Nov 1, 1921, *Five Finger Mt., Fan Ya* (五指嶺,番也), 8458, Dec. 7, 1921 and *Hainan, near T'a Hon* (海南.近嗒寒), 9216, Apr. 21, 1922; edge of thicket, hillside; alt., 250-1000 m.; shrub; ht., 2-3½ m.; fls., greenish yellow, brown; the leaves are used by Lois; crushed and bound over a broken bone; name reported, *Tso pun* (草盆).

236.6285—ARDISIA CRISPA (Thunb.) A. DC.

Nodoa (那大), 7897, Oct. 31, 1921 and *Hainan, W. of Tai Wan San Hu* (海南.大環之西部 新墟), 8960, Apr. 10, 1922; moist, shady places; bush; ht., 1 m.; fls., lavender; drug plant; name reported, *Siu lo san* (小羅傘).

An economic specimen of this plant secured on the Canton market by E. H. Groff under the name of *Siu lo san* (小羅傘), C. C. C. Ec. No. 158. The price is 30 cents per catty. It is reported to be used with five or six other herbs, made into a tea with wine and drunk for broken bones or sprain. It is also used externally.

236.6285—ARDISIA KONISHII Hayata

Nodoa, Lin Fa Ling (那大,蓮花嶺), 8073, Nov. 3, 1921, *T'a Hon* (他寒), 8337, Dec. 5 1921, *Five Finger Mt.*, (五指嶺), 8504, Dec. 22 1921 and 9338, Apr. 28, 1922; shrubby hillside, wooded ravine; alt., 600-1200 m.; shrub; ht., 2-2½ m.; frs., red when ripe.

236.6285—ARDISIA MACLUREI Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 351.

Five Finger Mt., (五指嶺), 8668, Dec. 15, 1921, *Hainan, S. slope of Five Finger Mt.*, (海南,五指嶺之南麓), 9416, May 4, 1922 and *Hainan, S slope of Five Finger Mt.*, (海南,五指嶺之南麓), 9552, May 13, 1922; wooded ravine in leaf mold, in heavily wooded ravine in rich loose soil in heavy forest; alt., 1200 m.; herb; fls., greenish yellow; frs., red.

236.6285—ARDISIA MAMILLATA Hance

Five Finger Mt., (五指嶺), 8690, Dec. 14, 1921 and *Hainan, below cave, S. slope of Five Finger Mt.*, (海南,穴下,五指嶺之南麓), 9333, Apr. 28, 1922; wooded ravine; on wooded mt. side in rich soil; alt., 1200 m.; herb; fls., lavender; frs., red; leaves with lavender pubescence.

236.6285—ARDISIA PACHYPHYLLA Dunn

Hainan, near Ting On River (海南,近定安河), 8882, Apr. 7, 1922 and *Hainan, Tai Wan, San Hu* (海南,大環,新墟), 8956, Apr. 10, 1922; stony bank near water, waste land; alt., 40 m.; ht., 2 m.; fls., lavender; frs., edible; name reported, *Lo san* (羅傘).

236.6285—ARDISIA PRIMULAEFOLIA Gardn. & Champ.

Five Finger Mt., (五指嶺), 8641, Dec. 16, 1921 and *Hainan, near cave, S. slope of Five Finger Mt.*, (海南 近穴,五指嶺之南麓), 9335, Apr. 28, 1922; wooded mt. side in leaf mold and rich soil; alt., 1000 m.; herb; fls., lavender; frs., red.

236.6285—ARDISIA QUINQUEGONA Blume

Nodoa (那大), 7930, Oct. 28, 1921, *Five Finger Mt.*, (五指嶺), 8595, Dec. 16, 1921, *Hainan, W. of Notia* (和舍之西部), 8967, Apr. 11, 1922, *Hainan, near cave, S. slope of Five Finger Mt.*, (海南,近穴,五指嶺之南麓), 9442, May 5, 1922 and 9473, May 7, 1922; edge of ravine, wooded mt. side, on shrub in waste land; alt., 250-1400 m.; shrub; ht., 2-3 m.; dia., 1½ 2½ cm.; fls., yellowish white; frs., reddish, purplish black; drug plant; name reported, *Lo san shu* (羅傘樹).

236.6285—ARDISIA REPTANS Merr.

8481**.

236.6285—ARDISIA VILLOSA Roxb.

Five Finger Mt., (五指嶺), 8671, Dec. 15, 1921 and 9336, Apr 28, 1922; wooded mt. side; herb; ht., 1/3-½ m.; fls., lavender; frs., red.

236.6285—ARDISIA SP.

Five Finger Mt., (五指嶺), 8534, Dec. 18, 1921; shrubby hillside, wooded ravine; alt., 600-1200 m.; bush; ht., 1/3-2½ m.; frs., red.

236.6310—EMBELIA LAETA (Linn.) Mez.

Hainan, Kingchow (海南,瓊州), 8821, Apr. 5, 1922; grassy waste place; alt., 10 m; ht., 2 m.; said by natives to be good for relieving thirst; have seen the Lois eat the young shoots; they have an acid, somewhat refreshing taste; name reported, *Sun t'ang kwo* (酸藤菓).

236.6310—EMBELIA RIBES Burm. f.

Nodoa (那大), 7948, Nov. 9, 1921, *Five Finger Mt., Fan Ya* (五指嶺 番也), 8402, Dec. 9, 1921, *Hainan, W. of Notia* (海南,和舍之西), 8982, Apr. 11, 1922 and *Hainan, Fan Ya, Yik Tsok Mau* (海南,番也,亦作茂). 9660, May 17, 1922; in brush at roadside, mt. side forest, in waste land on shrubs, in thicket; alt., 250-1000 m.; vine; ht., 3-6 m.; fls., greenish white; frs., edible, black when ripe; name reported, *Yeung kung pan tsai* (羊公板仔).

236.6310—EMBELIA SCANDENS (Lour.) Mez.

Five Finger Mt., (五指嶺), 8482, Dec. 23, 1921 and *Hainan, near Fan Ya* (海南 近番也), 9540, May 12, 1922; wooded ravine, among second growth on hillside; alt., 600 m.; vine; ht., 4-10 m.; dia., 3 cm.

237—Primulaceae

237.6330—LYSIMACHIA DECURRENS Forest

Hainan, Fan Ya (海南 番也), 9292, Apr. 26, 1922; on moist shady bank; herb; ht., ½-2/3 m.; fls., white.

238—Plumbaginaceae

238.6343—PLUMBAGO ZEYLANICA Linn.

Hoihow (海口). 7593, Oct. 10, 1921 and *Kingchow* (瓊州), 8822, Apr 5, 1922; on city wall; vine; alt, 10 m.; ht, 3 m.; fls., white, faintly fragrant; drug plant; name reported, *Pak fa pong* (白花榜).

238.6351—STATICE SINENSIS Girard.

Hoihow (海口), 7560, Oct. 10, 1921; sandy, grassy field; herb; fls., white.

239—Sapotaceae

239.6338—SIDEROXYLON ROSTRATUM Merr. SP. NOV.
in PHILIP JOURN. SCI. 21 (1922) 351.

Five Finger Mt., (五指嶺), 8559, Dec. 20, 1921; wooded ravine at edge of stream; tree; ht., 10 m.; dia., 20 cm.

239.6368—SIDEROXYLON SP.

Five Finger Mt., (五指嶺), 8488, Dec. 23, 1921 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9674, May 18, 1922; wooded ravine; alt., 650 m.; tree; ht, 5-15 m.; dia., 12-45 cm.; fls., white.

239.6372—SARCOSPERMA LAURINA (Benth.) Hook. f.

Nam Fung, Hong Ma Ts'un (南風 康馬村), 8301, Dec. 2, 1921; ravine; alt., 350 m.; tree; ht., 7 m.; dia, 12 cm.; fls., yellowish, fragrant.

240–Ebenaceae

240.6403—DIOSPYROS CARDIOPHYLLA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 352.

Nga Wan (牙睘), 8349, Dec. 6, 1921; hillside; alt., 650 m.; shrub; ht., 2 m.

240.6406—DIOSPYROS ERIANTHA Champ.

Five Finger Mt., (五指嶺), 8489, Dec. 23, 1921; wooded ravine; alt., 900 m.; tree; ht., 5 m.; dia., 10 cm.

240.6403—DIOSPYROS HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 258.

Five Finger Mt., *Yik Tsok Mau* (五指嶺,亦作茂), 8462, Dec. 16, 1921, 9320, Apr. 28, 1922 and 9748, May 19, 1922; wooded mt. side; alt., 1200 m.; tree; ht., 9-18 m.; dia., 20-50 cm.; frs., covered with thick brown pubescence; eaten by monkeys and Lois; wood is very hard, used to make coffins mostly; most durable when in ground; the wood is black when mature; the old Loi chiefs make their pipe stems of it; names reported, *Ngau kan shu* (牛筋樹), *Ngau kam shu* (牛金樹), *Ngau kam muk* (牛金木), *Ngau kan muk* (牛筋木).

McClure secured an economic specimen of this wood, C. C. C. Ec. 149 (McClure 92).

240.6406—DIOSPYROS MACLUREI Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 259.

Five Finger Mt., *Yik Tsok Mau* (五指嶺,亦作茂), 8463, Dec. 24, 1921, 8657, Dec. 20, 1921 and 9643, May 17, 1922.

240.6406—DIOSPYROS SP.

T'a Hon (咃寒), 8339, Dec. 5, 1921, *Five Finger Mt.*, (五指嶺), 8368, Dec. 10, 1921 and *Hainan, near Fan Ya* (海南近番也), 9278, Apr. 25, 1922; stream bank, wooded ravine; alt., 400-1200 m.; tree; ht., 4-10 m.; dia., 3-25 cm.; fls., yellowish-green, white, slightly fragrant.

241–Styracaceae

241.6411—STYRAX FABERI Perk.

Five Finger Mt., (五指嶺), 9566, May 13, 1922; wooded ravine; shrub; ht., 2½ m.; dia., 5 cm.

241.6412—ALNIPHYLLUM FORTUNEI (Hemsl.) Perk.

Five Finger Mt., (五指嶺), 9367, Apr. 29, 1922; wooded ravine; tree; ht., 30 m.; dia., 75 cm.

242–Symplocaceae

242.6418—SYMPLOCOS JAVANICA (Blume) Kerz.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7899, Nov. 1, 1921 and *Nodoa* (那大), 7951, Nov. 9, 1921; edge of thicket, roadside in hedge; alt., 250 m.; shrub; ht., 3-4 m.; dia., 10 cm.; fls., white, fragrant; name reported, *Fo fui shu* (火灰樹).

242.6418—SYMPLOCOS LANCILIMBA SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 259.

Hainan, Yik Tsok Mau (海南.亦作茂), 9672, May 18, 1922.

242.6418—SYMPLOCOS MACLUREI Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 260.

Five Finger Mt., (五指嶺). 9461, May 6, 1922; wooded ravine; tree; ht., 10 m.; dia., 12 cm.

242.6418—SYMPLOCOS PROPINQUA Hance

Nodoa (那大), 7704, Oct. 28, 1921, *Nodoa, Pat Ka Ling* (那大,筆架嶺), 8046, Nov. 1, 1921 and *Nodoa, Yau Ma Wo* (那大,油蔴和), 8118, Nov. 9, 1921, *Hainan, W. of Nodoa* (海南 和舍之西), 8969, Apr. 11, 1922; edge of thicket, dry roadside, dry, grassy hillside, in shrubby waste land; alt., 250 m.; shrub; ht., 1-3 m.; dia., 10 cm; fls., yellowish green, white, fragrant; names reported, *U hau muk* (烏口木), *Shan ma lut* (山蔴栗).

242.6418—SYMPLOCOS SCHAEFFERAE Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 260.

Hainan, Kachek, Wong Chuk (海南 嘉積. ?), 9781, June 1, 1922.

242.6418—SYMPLOCOS SP.

Five Finger Mt., (五指嶺), 9443, May 5, 1922; wooded ravine, roadside; tree; ht., 4-10 m; dia, 5-10 cm.; fls., white, fragrant.

243—Oleaceae

243.6434—OLEA BRACHIATA (Lour.) Merr.
(TETRAPILUS BRACHIATUS Lour.)

Five Finger Mt., (五指嶺), 9592, May 9, 1922; wooded ravine; shrub; ht., 2½ m.; dia., 2 m.; fls., greenish yellow.

243.6440—JASMINUM MICROCALYX Hance

Hoihow (海口), 7595, Oct 10, 1921; dry thicket; bush; fls., white, fragrant.

243.6440—JASMINUM NERVOSUM Lour.

Hainan, Ka La (海南,加拉), 9193, Apr. 20, 1922, *Hainan, Fan Ya* (海南,番也), 9530, May 11, 1922 and *Hainan, Kachek, Wong Chuk* (海南,嘉積, ?), 9792, June 1, 1922; on shrub in village commons, on bush at roadside; vine; ht., 2-4 m.; fls., white, fragrant; frs., purple, black when ripe; name reported, *Chak u tam* (鯽魚膽).

243.6440—JASMINUM UNDULATUM Ker.

Hoihow (海口), 7618, Oct. 12, 1921, *Nam Fung* (南風), 8272, Nov. 28, 1921, *Hong Ma Ts'un* (康馬村), 8297, Dec. 3, 1921, 8315, *Five Finger Mt., Hōp Lo Ts'un* (五指嶺 合籮村), 8354, Dec. 6 1921 and *Hainan, Kingchow* (海南 瓊州), 8805, 8810, Apr 5, 1922; foot of wall, village commons, thicket on shrubs, roadside; alt., 250-400 m.; vine; ht., 1-7 m.; fls., white, blue lavender, very fragrant; frs, black; good ornamental; names reported, *Tse sam neung* (謝三娘), *Tai chung mut li* (大種茉莉), *Sai ka mut li* (細假茉莉).

245—Loganiaceae

245.6460—STRYCHNOS ANGUSTIFLORA Benth.

Tai Un (大園), 8253, Oct. 27, 1921 and *Hainan, T'a Hon, Nga Wan* (海南 咃寒,牙環), 9242, Apr. 22, 1922; edge of thicket, hillside among shrubs; shrub; ht., 2-6 m.; dia., 1½-3 cm.; fls., cream, very fragrant with fragrance of cloves or carnations; frs., orange yellow; good ornamental.

245.6460—STRYCHNOS RUPICOLA Pierre

Hainan, W. of Notia (海南 和舍之西), 8981, Apr. 11, 1922; on shrubs in waste land; ht., 3-4 m.; fls, cream; the hooks that develop on the older stems are collected by the natives and used in treatment of convulsions in children; name reported, *Ngau t'ang* (鉤藤).

Economic specimen of this secured on the Canton market by E. H. Groff under the name of *Ngau t'ang* (鉤藤), C. C. C. Ec. No. 161. The people of Canton use it the same as reported by Mr. McClure. The price is about 60 cents per catty L.S.

245.6460—STRYCHNOS SP.

Ooi Diok (?), 8783, Oct. 12, 1921; roadside; shrub; ht., 2½ m.; frs., orange yellow.

245.6464—FAGRAEA CHINENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 261.

Nodoa, Sha Po Ling (那大,沙煲嶺), 8187, Nov. 11, 1921 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9724, May 19, 1922; moist ravine on large tree, wooded ravine; vine; ht., 4-5 m.; dia., 8 cm.; fls., white, very fragrant.

245.6473—BUDDLEIA ASIATICA Lour.

Five Finger Mt., Fan Ya (五指嶺.番也), 8391, Dec, 9, 1921 and *Hainan, Kingchow* (海南,瓊州), 8843, Apr. 5, 1922; hillside, roadside; alt., 10-1000 m.; shrub; ht., 1-2 m.; fls., white; drug plant; names reported, *Pok kwat tan* (駁骨丹), *Shui yeung lau* (水楊柳).

246—Gentianaceae

246.6512—SWEERTIA PULCHELLA Ham.

Five Finger Mt., Hop Lo Ts'un (五指嶺,合籮村), 8366, Dec. 6, 1921; hillside among short grass; alt., 800 m.; herb; fls., white.

246.6545—LIMNANTHEMUM INDICUM (Linn.) Thw.

Kingchow (瓊州), 7642, Oct. 14. 1921; pond; herb; fls., white; name reported, *Shui fau lin* (水浮蓮).

247—Apocynaceae

247.6550—MELODINUS MONAGYNUS Roxb.

Nodoa Lin Fa Ling (那大,蓮花嶺), 8097, Nov. 3. 1921 and *Hainan, S. of Shui Mun* (海南 水門之東南), 9598, May 14, 1922; forest in trees, on tall tree on wooded mt. side; alt., 400 m.; vine; ht., 5-10 m.; dia., 3 cm.; fls., yellowish; frs., yellowish red, edible; drug plant; name reported, *Shan chang* (山橙).

Dried *Shan chang* (山橙), was secured on the Canton market by E. H. Groff, C. C. C. Ec. No. 162. The price is from 1 ct. to 6 cts. each. They are reported boiled with pork and the broth used as a cough syrup.

247.6597—LOCHNERA ROSEA Reich.

Hoihow, Hainan (海口,海南), 7562, Oct. 10, 1921; sandy edge of canal; fls., pink.

247.6603—TABERNAEMONTANA BUFALINA Lour.

Nodoa (那大), 7987, Nov. 13, 1921, *Hong Ma Ts'un* (康馬村), 8313, Dec. 3, 1921, *Five Finger Mt., Fan Ya* (五指嶺.番也), 8400, Dec. 9, 1921 and 8408, Dec. 1921 and *Hainan Ka La* (海南 加拉), 9212, Apr. 21, 1922; roadside, dry thicket, mt. side forest, wooded mt. side; alt., 800-1000 m.; shrub; ht., 1-3 m.; dia., 4 cm; frs, red; seeds, orange yellow when ripe; name reported, *Yeung kot shu* (羊角樹).

247.6603—TABERNAEMONTANA SP.

Hainan, Kingchow (海南 瓊州), 8820, Apr. 5, 1922 *Hainan, W. of Notia* (海南,和舍之西部), 8975, Apr. 11, 1922 and *Five Finger Mt.*, (五指嶺), 9472, May 7, 1922 and 9537, May 12, 1922; mt. side forest, roadside, among shrubs in waste land, in wooded ravine; tree; ht., 1/3-6 m.; dia., 4-8 cm.; fls., yellowish white; frs., brownish; drug plant; name reported, *Shan lat tsiu* (山辣椒).

247.6619—RAUWOLFIA VERTICILLATA (Lour.) Baill.

Mai Kun Ts'un (米覲村), 7664, Oct. 25, 1921, *Pat Ka Ling* (筆架嶺), 7689, Oct. 31, 1921, *Hong Ma Ts'un* (康馬村), 8312, Dec. 3, 1921, *Five Finger Mt.*, (五指嶺), 8665, Dec. 3, 1921 and *Hainan, near Shui Mun* (海南.近水門), 9597, May 14, 1922; roadside, edge of thicket, wooded ravine; alt., 250-400 m.; shrub; ht., 1-3 m.; frs., bright red.

247.6626—KOPSIA LANCIBRACTEOLATA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 262.

Near Ka La (近加拉), 9183, Apr. 20, 1922; in ravine; tree; ht., 6 m.; fls., white, very fragrant; frs., blue black; when branches or fruits are broken, a sticky milk exudes; fruits secured for seed; promising ornamental.

247.6638—MICRECHITES POLYANTHA (Blume) Miq.

Hainan, near Fan Ya (海南.近番也), 9280, Apr. 25, 1922; on shrub in ravine; vine; ht., 5-6 m.; fls., yellow.

247.6666—RHYNCHODIA RHYNCHOSPERMA (Wall.) K. Schum.

Five Finger Mt., (五指嶺), 8388, Dec. 10, 1921 and *Hainan, Fan Ya* (海南,番也), 9297, Apr. 26, 1922; hillside on tree, in thicket; alt., 1000 m.; ht., 5-6 m.; dia., 5 cm.; fls., cream, fragrant.

247.6682—EPIGYNUM CHINENSE SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 262.

Hainan, Yik Tsok Mau (海南.亦作茂), 9710, May 18, 1922 and *Five Finger Mt.*, (五指嶺), 8616, Dec. 21, 1921; on tree in wooded ravine ht., 3-4 m.; fls., white.

247.6688—STROPHANTHUS ALTERNIFOLIUS (Lour.) Spreng.
(S. DIVERGENS Grah.)

Hainan, Kingchow (海南,瓊州), 8815, Apr. 5, 1922; roadside; alt., 10 m.; ht., 1-2 m.; fls., light yellow; name reported, *Yeung kok ngau* (羊角咬)

247.6689—WRIGHTIA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 352.

Five Finger Mt., (五指嶺), 8685, Dec. 21, 1921, *Hainan, Fan Ya* (海南,番也), 9488, May 8, 1922 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9718, May 19, 1922; wooded ravine, village commons; alt., 700 m.; tree; ht., 3-7 m.; dia., 2½-12 cm.; fls., yellow.

247.6689—WRIGHTIA PUBESCENS R. Brown

Hoihow (海口), 7646, Oct. 11, 1921, *Five Finger Mt.*, (五指嶺), 8611, Dec. 26, 1921, *Hainan, Keuk Ha Ts'un* (海南, ?), 8911, Apr. 8, 1922 and *Hainan, Nodoa* (海南,那大), 9820, Apr. 15, 1922; dry door yard, open mt. side, on river bank, in sandy clay soil not cultivated; tree; alt., 50-700 m.; ht., 1-5 m; dia., 6-10 cm.; fls., white; the wood of this tree is used to make name stamps; leaves are fed to hogs; names reported, *To tiu pat* (倒吊筆), *Nin cheung shu* ([illegible]醬樹).

247.6693—POTTSIA LAXIFLORA (Blume) O. Ktze.
(P. CANTONIENSIS H. & A.)

Nodoa (那大), 7923, Oct. 21, 1921, *Hainan, W. of Notia* (海南,和舍西部), 8979, Apr. 11, 1922, *Hainan, Fan Ya* (海南,番也), 9513, May 9, 1922; edge of stream on shrubs, in waste land, on shrubs at roadside; alt., 250 m.; vine; ht., 1-5 m.; fls., white, lavender; the Lois use this vine to lead the water buffalo; it is very tough and is considered by them to be the toughest vine outside of the rattan.

247.????—

Five Finger Mt., Fan Ya Ts'un (五指嶺,番也村), 8438, Dec. 17, 1921; alt., 600 m.; bush; ht., 1½ m.; fls., white.

248—Asclepiadaceae

248.6740—CRYTOLEPIS ELEGANS (Lour.) Merr.

Hoihow (海口), 7652, Oct. 10, 1921; dry places; vine; name reported, *Yeung kok t'ang* (羊角籐).

248.6791—ASCLEPIAS CURASSAVICA Linn.

Hoihow (海口), 7623, Oct. 11, 1921, *Ka La* (加拉), 8319, Dec. 4, 1921 and 9203, Apr. 21, 1922; grave land, roadside, along stream in grassy places; alt., 350 m.; shrub; ht., 1/3-2 m.; fls., red, yellow, maroon, orange; names reported, *Kam fung fa* (金鳳花), *Sz kwai fa* (四季花), *Kam fung* (金鳳).

248.6834—CYNANCHUM INSULANUM (Hance) Hemsl.

Hainan, Kingchow (海南,瓊州), 8828, Apr. 5, 1922; grassy place at roadside; alt., 10 m.; ht., 2 m.; fls., white.

248.6860—SECAMONE SP.

Nodoa, Pat Ka Ling (那大,筆架嶺), 7900, Nov. 1, 1921; alt., 250 m.; vine; name reported, *Yeung kok t'ang* (羊角籐).

248.6891—GYMNEMA AFFINE Decne

Hoihow, Hainan (海口,海南), 7546, Oct. 11, 1921 and *Hainan, Kachek, Wong Chuk* (海南.嘉積, ?), 9786, June 1, 1922; on city wall, on bushes at roadside; vine; ht., 4.5 m.; fls., greenish yellow, slightly fragrant; name reported, *Yeung kok t'ang* (羊角藤).

248.6895—PENTASACME CAUDATUM Wall.

Five Finger Mt., (五指嶺), 8555, Dec. 20, 1921 and *Hainan, Yik Tsok Mau* (海南.亦作茂), 9709, May 18, 1922; moist shady ravine in rock crevices near water, in wooded ravine; alt., 600 m.; bush; ht., 1/3 m.; fls., white, fragrant.

248.6907—HOYA CARNOSA (Linn.) R. Br.

Near Tai Tsing (近大井), 7889, Oct. 24, 1921; roadside on stone wall; vine; fls., yellowish white.

248.6907—HOYA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 263.

Five Finger Mt., (五指嶺), 9759, May 1922; on trunk of tree; vine; ht., 3.4 m.; fls., white, slightly fragrant.

248.6907—HOYA OBSCURINERVIA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 263.

Hainan, San Ts'un, near Nodoa (海南 新村.近那大), 9819, Apr. 15, 1922; on trees in village commons; vine; ht., 3-4 m; fls., white; name reported, *A neung hai* (亞娘鞋).

248.6911—MARSDENIA SP.

Nam Fung (南風), 8267, Nov. 30, 1921; village commons; alt., 250 m.; vine; name reported, *Ch'un kan t'ang* (春根藤).

248.6916—HETEROSTOMMA OBLONGIFOLIUM Cost.

Five Finger Mt., (五指嶺), 9313, 9317, Apr. 28, 1922; on trees; vine; "whip rattan"; ht., 30 m.

McClure secured an economic specimen of this C. C. C. Ec. No. 164 (McClure Ec. No. 98).

249—Convolvulaceae

249.6973—EVOLVULUS ALSINOIDES Linn.

Tai Un (大園), 8251, Jan. 3, 1922; edge of path; herb; prostrate; fls., light blue.

249.6989—ERYCIBE HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 353.

Five Finger Mt., (五指嶺), 8547, Dec. 20, 1921 and 9368, Apr. 29, 1922; mt. side forest on trees; wooded ravine alt., 700 m.; vine; ht., 10-30 m.; dia., 5 cm.

249.6989—ERYCIBE SP.

Five Finger Mt., (五指嶺), 9443, May 5, 1922; on tall tree in wooded ravine; vine; ht., 20 m.; dia., 5 cm.

249.6995—HEWITTIA SUBLOBATA (Linn. f.) O. Ktz.

Kingchow (瓊州), 7645, Oct. 14, 1921; grassy places; vine, fls., yellow.

249.6997—MERREMIA HASTATA (Burm. f.) Hall. f.
(IPOMOEA FILICAULIS Bl.)

Kam Kong (金江), 8247, Oct. 26, 1921; dry roadside; vine; prostrate.

249.6997—MERREMIA HIRTA (Linn.) Merr.

Nodoa, Ha Kung Ling (那大,蝦公嶺), 8223, 7756**, Nov. 21, 1921; near hot spring; growing on rocks; alt., 300 m.; fls., yellow.

249.7001—LEPISTEMON SP.

8401**; not identifiable to species.

249.7003—IPOMOEA BATATAS (Linn.) Poir.

On Yan (安仁), 7873, Oct. 25, 1921; cultivated field; vine; prostrate; fls., pink; root used as food.

249.7003—IPOMOEA DIGITATA Linn.

Hoihow (海口), 7579, Oct. 10, 1921; bamboo thicket; vine; fls., purple; name reported, *Ch'ak shau* (柵手)

249.7003—IPOMOEA OBSCURA (Linn.) Ker.

Kingchow (瓊州), 7643, Oct. 14, 1921; dry places; herb; fls., yellow.

249.7003—IPOMOEA PESCAPRAE (Linn.) Roth

Hoihow (海口), 7527, Oct. 9, 1921 and 9829, Jan. 7, 1922 and *Kingchow* (瓊州), 8832, Apr. 5, 1922; sandy waste; alt., 10 m.; vine; ht., 7-15 m.; fls., pink; vine and leaves used as pig feed by natives; name reported, *Hau t'ang* (厚藤).

249.7003—IPOMOEA REPTANS (Linn.) Poir.

Nodoa, San Ts'un (那大,新村), 8007, Nov. 15, 1921; dry village garden; alt., 250 m.; vegetable; fls., white; name reported, *Ung ts'oi* (甕菜).

249.7003—IPOMOEA STAPHYLINA R. & S.

Nodoa (那大), 7778, Oct. 28, 1921 and *Fan Ya* (番也), 9641, May 16, 1922; roadside on shrubs, on hillside; alt., 250 m.; vine; ht., 10 m.; fls., yellow, pink.

249.7009—ARGYREIA CAPITATA (Vahl.) Choisy
(LETTSOMIA STRIGOSA Roxb.)

Notia (和舍), 8240, Oct. 27, 1921 and *Fan Ta, to Nam Fung* (番打,到南風), 8259, Dec. 30, 1921; roadside climbing on shrubs, sandy dry soil, in thicket near village; alt., 250-400 m.; vine; fls., white, pink.

249.7009—ARGYREIA OBTUSIFOLIA Lour.
(A. ACUTA Lour.)

Tai Tsing (大井), 7668, Oct. 24, 1921 and *Notia* (和舍), 8241, Dec. 27, 1921; roadside on wall; vine; fls., pink, greenish; frs., bright red; name reported, *Pak hok t'ang* (白鶴藤).

249.7009—ARGYREIA SP.

Hong Ma Ts'un (康馬村), 8317, Dec. 3, 1921; in thicket near village; alt., 400 m.; vine; fls., white; name reported, *Ye ch'a ts'oi* (野茶菜).

249.7010—STICTOCARDIA CAMPANULATA (Linn.) Merr.

Enroute Hoihow to Tai Tsing (海口到大井), 7748, Oct. 24, 1921; roadside on bushes; vine; ht., 3-4 m.; fls., pink.

249.7010—STICTOCARDIA SP.

Nodoa, Sha Po Ling (那大,沙婆嶺), 8197, Nov. 11, 1921 and *Five Finger Mt.*, (五指嶺), 8629, Dec. 1921; on shrub in shady ravine, hillside on shrubs; alt., 400-700 m.; vine; fls., white.

252—Borraginaceae

255.7038—CORDIA DICHOTOMA Forest. f.
(C. MYXA AUCTT. non. L.)

Ka La (加拉), 9184, Apr. 20, 1922 and *Fan Ya* (番也), 9639, May 16, 1922; in ravine, on partially wooded hillside; tree; ht., 5-8 m.; dia., 15 cm.; fruits used to stupefy fish; names reported, *Fung chang shu* (風箏樹), *Kau shu* (膠樹).

252.7043—EHRETIA LAEVIS Roxb.

Five Finger Mt., (五指嶺), 9475, May 7, 1922; wooded ravine; tree; ht., 15 m.; dia., 25 cm.; fls., white, out before the leaves; this is evidently a deciduous tree; the wood of this tree is very soft.

252.7043—EHRETIA MICROPHYLLA Lam.
(E. BUXIFOLIA Roxb.)

Hoihow (海口), 7575, Oct. 11, 1921, *Kingchow* (瓊州), 8825, Apr. 5, 1922 and *Ka La* (加拉), 9189, Apr. 20, 1922; along city wall, waste places at roadside, open grassy terrace; alt., 10 m.; bush; ht., 1/3-2 m.; fls., brownish red, white; frs., red; names reported, *Miu tsai shu* (猫仔樹), *Ki kap shu* (基及樹).

252.7052—HELIOTROPIUM INDICUM Linn.

Tai Un (大園), 7771, Oct. 26, 1921 and *Kingchow* (瓊州), 8844, Apr. 5, 1922; dry roadside among shrubs; alt., 10 m.; herb; ht., 1 m.; fls., lavender with orange red center; drug plant; used for boils; names reported, *Fi yik ts'o* (飛翼草), *Tai fi ngau* (大肥餚).

253—Verbenaceae

253.7138—VERBENA OFFICINALIS Linn.

Hoihow (海口), 7590, Oct. 11, 1921 and *Fan Ta* (番打), 9153, Apr. 18, 1922; at foot of city wall, village commons; herb; ht., 1 m.; fls., blue, lavender; name reported, *Kau nga ts'o* (狗牙草). McClure reported this as a drug plant which is used for dog bites.

253.7144—LANTANA CAMERA Linn.

Hoihow (海口), 7608, Oct. 9, 1921 and *Nodoa* (那大), 7979, Nov. 15, 1921; dry thicket, village commons; alt., 250 m.; bush; fls., red, yellow, purple; frs., black; name reported, *U i ts'o* (如意草)

253.7145—LIPPIA NODIFLORA (Linn.) Rich.

Hoihow (海口). 7634, Oct. 9, 1921; dry, grassy places; vine; fls., blue.

253.7177—CALLICARPA BREVIPES Hance.

T'a Hon (他寒), 9222, Apr. 21, 1922; along stream; shrub; ht., 1-1½ m.; fls., white.

253.7177—CALLICARPA LONGIFOLIA Lam.

Nodoa, Pat Ka Ling (那大,筆架嶺), 8036, Nov. 1, 1921 and *Hainan, Yik Tsok Mau* (海南 亦作茂), 9743, May 19, 1922; edge of thicket, on grassy hillside; alt., 250 m.; shrub; ht., 2/3-3 m.; fls., lavender.

253.7177—CALLICARPA MACROPHYLLA Vahl

Five Finger Mt., (五指嶺), 9591, May 14, 1922; wooded ravine; shrub; ht., 2-3 m.; fls., white.

253.7177—CALLICARPA REEVESII Wall.

Nodoa (那大), 7984, Nov. 15, 1921; roadside; alt., 250 m.; shrub; ht., 2½ m.; dia., 5 m.; fls., purple; frs., white; name reported, *Pok kwat tan* (駁骨丹).

253.7177—CALLICARPA RUBELLA Lindl.

8150**.

253.7185—PREMNA HERBACEA Roxb.

Hainan, Enroute Nga Wan to Yik Tsok Mau (海南,牙環到亦作茂), 9260, Apr. 23, 1922; on hillside; herb; fls., purple in bud, white when open.

253.7185—PREMNA INTEGRIFOLIA Linn.

Hoihow (海口), 7594, Oct. 10, 1921; dry places, bush; fls., black.

253.7185—PREMNA SP.

Hainan, near Tau Ti P'o (海南近, ?), 9126, Apr. 18, 1922; among shrubs at roadside; shrub; frs., purple when ripe.

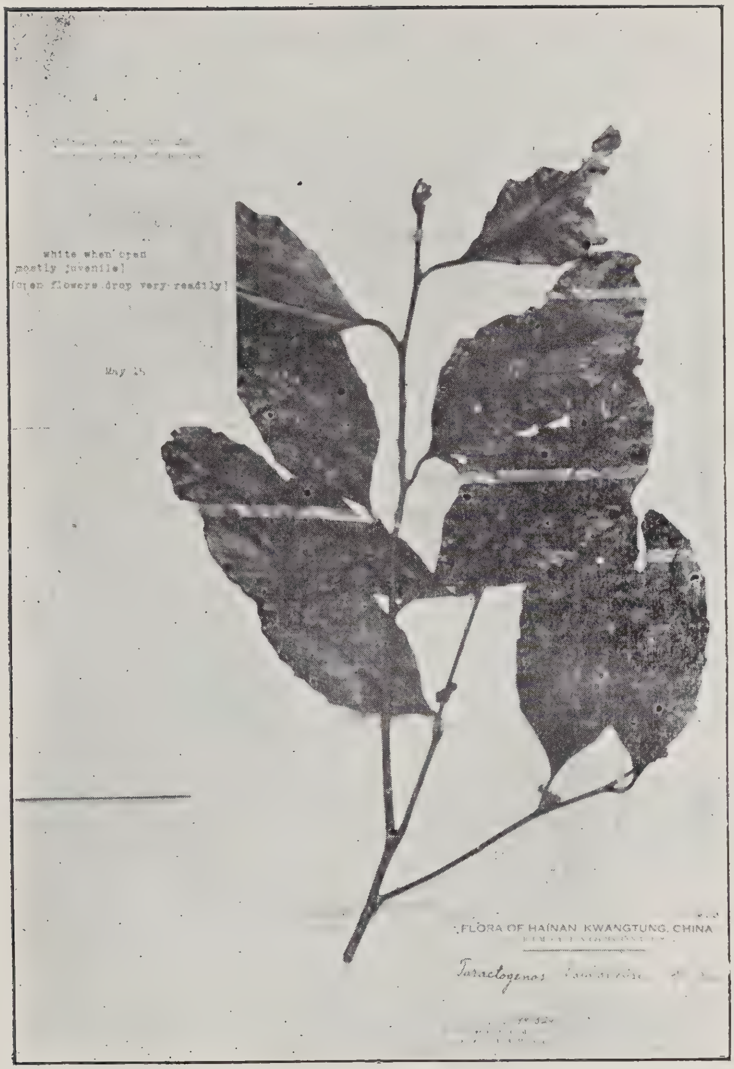
253.????—TSOONGIA AXILLIFLORA Merr. GEN. NOV. and SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 264.

Yik Tsok Mau (亦作茂), 9692, May 18, 1922; wooded ravine; herb; ht., 4-5 m.; dia., 3 cm.; fls., yellow.

Mr. Merrill records: "*Tsoongia* is most closely allied to *Premna*, and is somewhat intermediate between *Vitex* and *Premna*, although distinctly closer to the former." We place it in this position.

253.7186—VITEX NEGUNDO Linn.

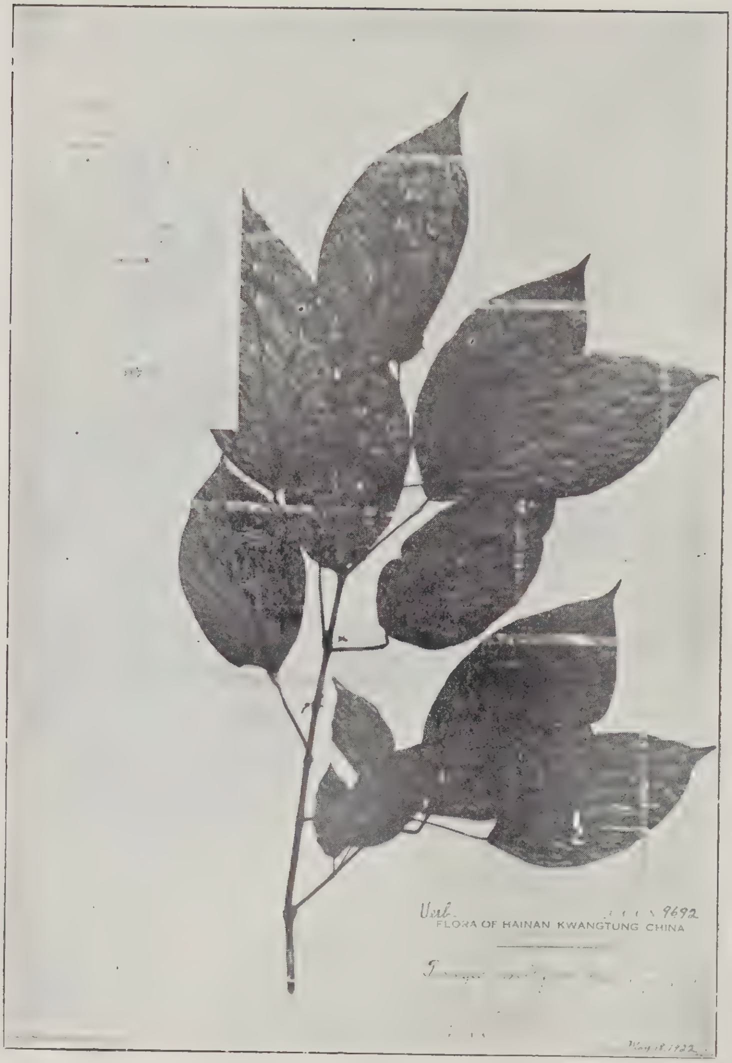
Ting On River (定安河), 8888, Apr. 7, 1922; sandy waste; alt., 50 m.; ht., 1-1 1/3 m.; fls., light blue; drug plant; bruised leaves used as poultice for bruises; name reported, *Hut kin shau* (血見愁).


white when open
mostly juvenile]
[open flowers drop very readily]
May 15
FLORA OF HAINAN KWANGTUNG, CHINA
Taractogenos

Herbarium Specimen of *Taraktogenos hainanensis* Merr. SP. NOV.

Fig. 1. Seeds of the species of this genus yield an oil known as chaulmoogra oil, the curative properties of which are well known in the treatment of skin diseases and especially leprosy. The chaulmoogra nuts are commonly found in the medicinal shops of China, and it has often been mistakenly believed that the tree is common in China. But never before has a species of the genus been reported from China. This herbarium specimen, collected by Mr. McClure, represents a new species which Mr. E. D. Merrill has named *Taraktogenos hainanensis* (The Philippine Journal of Science, Vol. 23, No. 3, September, 1923, page 255). It is most closely allied to *Taraktogenos serrata* Pierre of Indo China. The discovery of this tree reveals that Hainan may be a promising place for the production of chaulmoogra oil. The nuts of this species, native to Hainan, should be thoroughly tested and compared with *Taraktogenos kurzii* King, and other species, from which the oil is usually obtained.

Plate 4



Herbarium Specimen of *Tsoongia axillariflora* Merr. GEN. NOV. and SP. NOV.

Fig. 2. The genus and species of the plant shown above are both new to science. The plant was first recorded by Prof. K. K. Tsoong (Chung Koon Kong 鍾觀光) of Peking Government University when he travelled and collected in Southern Kwangtung in the year 1918. It is represented by his number 1908 with locality as Yam Chow (欽州). Mr. McClure collected the specimen shown above at Yik Tsok Mau (亦作茂) in Hainan, under the number 9692. Mr. Merrill has dedicated the genus to the first collector and described the species under the name *axillariflora* (The Philippine Journal of Science, Volume 23, No. 3, September, 1923, pages 264 and 265). He records that *Tsoongia* is most closely allied to *Premna*, and intermediate between *Vitex* and *Premna*

Plate 5

253.7186—VITEX QUINATA (Lour.) F. N. Will.

Pat Ka Ling, (*Nodoa*) (筆架嶺,(那大), 8041, Nov. 1, 1921; edge of thicket; tree; ht., 8 m.; dia., 25 cm.

253.7188—GMELINA HAINANENSIS Oliver.

Fan Ya (番也), 9281, Apr. 25, 1922; open grassy hillside; tree; ht., 5 m.; dia., 10 cm.; fls., white or pinkish on outside, lavender and orange inside.

253.7191—CLERODENDRON CANESCENS Wall.

Yik Tsok Mau (亦作茂), 9271, Apr. 23, 1922 and 9736, 9738, May 19 1922; on open grassy hillside; shrub; ht., 1-2 m.; dia., 2 m.; fls., white and red.

253.7191—CLERODENDRON CYRTOPHYLLUM Turcz.

Hoihow (海口), 7572, Oct. 10, 1921 and *Fan Ya* (番也), 9489, May 8, 1922; thicket. at edge of stream; shrub; ht, 1½-2 m.; fls., white; the Ius (the North River, Kwangtung aborigenes) eat the leaves of this plant as vegetable; name reported, *Iu tsz ts'oi* (傜子菜).

253.7191—CLERODENDRON FRAGRANS Vent.

Hainan, near Ka La (海南,近加拉), 9207, Apr. 21, 1922; along stream; bush; ht., 1 m.; fls., white; frs., immature; drug plant; root used; name reported, *Ch'au shi mut li* (臭屎茉莉).

A specimen of this was obtained on the Canton market by E. H. Groff, C. C. C. Ec. No. 165, under the name of *Ch'au shi mut li* (臭屎茉莉). The roots when dried well for about five hours are then taken internally for weak muscles of the legs.

253.7191—CLERODENDRON INERME Gaertn.

Hoihow (海口), 7610, Oct. 9, 1921 and *Ting On River* (定安河), 8910, Apr. 7, 1922; dry thicket, dry sandy waste places; bush; ht., 1 m.; fls., white with maroon stamens, very fragrant; name reported, *Fu long* (苦朗).

253.7191—CLERODENDRON PANICULATUM Linn.

Kingchow (瓊州), 7627, Oct. 14, 1921; ht., 1 m.; fls., brilliant red.

253.7191—CLERODENDRON SQUAMATUM Vahl.
(an C. PANICULATUM L. var. ?)

Ting On River (定安河), 8854, Apr. 6, 1922; edge of thicket: alt., 50 m.; ht., 1/3-½ m.; fls., brilliant; name reported, *Ch'au shi mut li* (臭屎茉莉).

253.7191—CLERODENDRON SP.

Five Finger Mt., Fan Ya (五指嶺 番也), 8371, Dec. 10, 1921; moist shady ravine; alt., 1200 m.; fls., white; frs., white.

253.7203—SPHENODESMA PENTANDRA Jack.

Fan Lun, Ka La (番掄,加拉), 9178, Apr. 20, 1922; shrub; ht., 3 m.; fls., whitish with yellowish center.

253.7203—SPHENODESMA UNGUICULATA Schauer.

T'a Hon (咃寒), 8331, Dec. 20, 1921; hillside; alt., 650 m.; shrub; ht., 2½ m.

254—Labiatae

254.7212—TEUCRIUM JAPONICUM Willd.

Yik Tsok Mau Ts'un, Five Finger Mt., (亦作茂村,五指嶺), 8466, Dec. 21, 1921; village commons; alt., 600 m.; herb; ht., 1/3 m ; fls., lavender.

254.7234—SCUTELLARIA INDICA Linn.

Five Finger Mt., (五指嶺), 9400, May 1, 1922 and *Yik Tsok Mau* (亦作茂), 9708, May 18, 1922; in moist shady nook in cliff, in wooded ravine; herb; fls., lavender.

254.7234—SCUTELLARIA JAVANICA Jungh.

Enroute Oo P'o to Sheun P'o (?), 9771, May 29, 1922; growing along path in dense thicket; herb; ht., 1/3-½ m.; fls., purple.

254.7234—SCUTELLARIA RIVULARIS Wall.

Ting On River (定安河), 8878, Apr. 6, 1922; on terraces between rice fields; alt., 40 m.; dia., 15 cm.; fls., blue.

254.7234—SCUTELLARIA SP.

Nam Fung (南風), 8271, Nov. 28, 1921; village commons, along path in dense thicket; alt., 250 m.; herb; ht., 1/3-1 m.; fls., yellow, purple; name reported, *Ka mak ts'o* (假麥草).

254.7268—LEUCAS ZEYLANICA (Linn.) R. Br.

Hoihow (海口), 7563, Oct. 12, 1921 and 7587, Oct. 10, 1921, and *Ting On River* (定安河), 8871, Apr. 6, 1922; sandy waste, dry grassy field, sandy idle field; alt., 40 m.; herb; dia., 15 cm.; fls., white specked with purple.

254.7273—LEONURUS SIBIRICUS Linn.

Hoihow (海口), 7540, Oct. 11, 1921 and *Five Finger Mt., Yik Tsok Mau Ts'un* (五指嶺,亦作茂村), 8467, Dec. 21, 1921; thicket, village commons; alt., 600 m.; herb; ht., 1/3-1 m.; fls., pink, lavender; name reported, *Hung fa ngai* (紅花艾).

254.7284—ANISOMELES INDICA (Linn.)

Hoihow (海口), 7637, Oct. 11, 1921 and *Ting On River* (定安河), 8877, Apr. 6, 1922; dry grassy places, among trees in waste places; alt., 40 m.; herb; ht., 1/3-1/2 m.; fls., blue, white; drug plant; name reported, *Mat ts'o* (蜜草).

254.7332—PERILLA OCYMOIDES Linn.

Nodoa, Yau Ma Wo (那大,油蔴和), 8112, Nov. 9, 1921; village commons; herb; drug plant used for colds, coughs, and fever; name reported, *Tsz so* (紫蘇).

An economic specimen of this was purchased on the Canton market under the name *Tsz so* (紫蘇), C. C. C. Ec. No. 167. The price is about 30 cents per catty L. S. This is found on Honam Island opposite Canton city. It is also used as a flavor with *Tau shi* (荳豉), the portion of the bean which is left after draining the soy sauce from the jars. To this is added pork and *Tsz so* (紫蘇). This is a very common dish and the Chinese like the flavor.

254.7337—POGOSTEMON GLABER Benth.

Five Finger Mt., Fan Ya (五指嶺.番也), 8454, Dec. 7, 1921 and *Fan Ya* (番也), 9491, May. 8, 1922; roadside, on open grassy hillside; alt., 1000 m.; bush; ht., 1 m.; fls., lavender, purple; Lois gather the leaves, beat and grind out the water, and rub on mosquite bites to relieve the pain and itching.

254.7338—DYSOPHYLLA AURICULARIA (Linn.) Blume

Fan Ya (番也), 9279, Apr. 25, 1922; open moist grassy hillside; herb; ht., 1/3-½ m.; fls., purple.

254.7338—DYSOPHYLLA VERTICILLATA (Roxb.) Benth.

Kingchow (瓊州), 7542, Oct. 14, 1921, *Nodoa* (那大), 7708, Oct. 30, 1921 and *Nodoa, Lin Fa Ling* (那大,蓮花嶺), 8106, Nov. 21, 1921; swampy field, wet grassy place; alt., 250 m.; ht., 1/3 m.; fls., lavender.

254.7342—HYPTIS CAPITATA Jacq.

Kam Kong (金江), 7830, Oct. 26, 1921, *Nam Fung* (南風), 8269, Nov. 28, 1921, *Tau Ti P'o* (?), 9127, Apr. 18, 1922 and *T'a Hon, Nga Wan* (咃寒, 牙環), 9240, Apr. 22, 1922; edge of dry cultivated field, village commons, at roadside along stream, along road among grass; alt., 250 m.; herb; ht, 1/3-2 m.; fls., light blue, lavender, white with fine maroon specks on upper lip; frs., brown; names reported, *Sz fong kwat* (四方骨), *Ka tsau ma fung* (假走馬風).

254.7342—HYPTIS SUAVEOLENS Poir.

Hoihow (海口), 7525, Oct. 11, 1921; outside city wall in dry grassy place; herb; ht., 1/3 m.; fls., pink.

254.7350—PLECTRANTHUS SP.

T'a Hon (咃寒), 8338, Dec. 5, 1921; edge of stream; alt., 300 m.; fls., pinkish white.

254.7355—COLEUS BLUMEI Benth.

Ka La to Fan Ta (加拉到番打), 8322, Dec. 29, 1921; roadside; alt., 350 m.; ht., 1/3-1 m.; fls., light blue.

254.7355—COLEUS PUMILUS Blance
(C. GAUDICHAUDII Brig.)

Ka La Village (加拉鄉), 9201, Apr. 21, 1922; village commons; herb; ht., 1/3-2/3 m.; fls., deep blue.

254.7366—OCIMUM GRATISSIMUM Linn.

Ting On River (定安河), 8921, Apr. 8, 1922; in sandy waste land; alt., 60 m.; ht., 1/3 m.; name reported, *Ch'au ts'o* (臭草).

254.7367—ORTHOSIPHON SPIRALIS (Lour.) Merr.
(O. STAMINENS Benth; TRICHOSTEMA Lour.)

Nodoa (那大), 7861, Nov. 1, 1921 and *Nodoa, Pat Ka Ling*, (那大.筆架嶺), 8025, Nov. 1, 1921; edge of thicket, shady places; alt., 250 m.; herb; ht., 1.1½ m.; fls., blue, lavender.

254.7373a—NOSEMA PRUNELLOIDES (Hemsl.) Prain.

Mi Ting (美亭), 7680, 7721**, Oct. 25, 1921 and *Nodoa, Lin Fa Ling* (那大,蓮花嶺), 8099, Nov. 4, 1921; grassy field, grassy slope; alt., 400 m.; herb; fls., maroon, purple, white.

254 ? —PARAPHLOMIS RUGOSA (Benth.) Prain.

Five Finger Mt., (五指嶺), 8502, Dec. 22, 1921; wooded ravine; alt., 950 m.; bush; ht., 1 m.; frs., receptacle pale pink, seeds black.

256–Solanaceae

256.7379—LYCIUM CHINENSE Mill.

Nodoa (那大), 7994, Nov. 20, 1921; village garden; alt., 250 m.; bush; fls., red; drug plant; name reported, *Kau ki ts'oi* (枸杞菜).

256.7401—PHYSALIS MINIMA Linn.

Kingchow (瓊州), 7552, Oct. 14, 1921; grassy field; herb; name reported, *Ka tang lung* (假燈籠).

256.7404—CAPSICUM ANNUUM Linn.

Ka La (加拉), 9204, Apr. 21, 1922; cultivated in garden; bush; ht., 1½-2 m.; fls., white; frs., white until ripe then red; name reported, *Pak lat tsiu* (白辣椒).

256.7404—CAPSICUM FRUTESCENS Linn.

Hoihow (海口), 7599, Oct. 10, 1921, *Nodoa* (那大), 8052, Nov. 2, 1921 and *Ting On River* (定安河), 8857, Apr. 6, 1922; dry thicket, waste land; herb; ht, 1 1/3-30 m.; dia., ½ cm.; fls., white; frs., red, yellow, pungent to taste; name reported, *Ye shang lat ts'iu* (野生辣椒), *Ye lat ts'iu* (野辣椒).

256.7407—SOLANUM ACULCATISSIMUM Jacq.

Ting On River (定安河), 8889, Apr. 7, 1922; sand waste; alt., 50 m.; ht., 1/3 m.; fls., white; drug plant; name reported, *Tin k'e* (顛茄).

256.7407—SOLANUM BIFLORUM Lour.

Nam Fung (南風), 8268, Nov. 28, 1921, *Five Finger Mt.*, (五指嶺), 8624, Dec. 1921, *Fan Ya* (番也), 9517, May 9, 1922 and *Yik T'sok Mau* (亦作茂), 9699, May 18, 1922; village commons, at roadside under shrubs, in wooded ravine; alt., 250 m.; herb; ht, 1/3-2 m.; fls.; white; frs., red; name reported, *Sham nau kwo* (衫鈕菓).

256.7407—SOLANUM CUMINGII Dunal.

Hoihow (海口), 7641, Oct. 9, 1921; dry places; herb; ht., 2/3 m.; fls., blue; frs., yellow; name reported, *Tin k'e* (顛茄).

256.7407—SOLANUM DEBILISSIMUM Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 265.

Five Finger Mt., (五指嶺), 9532, May 11, 1922; edge of stream in wooded ravine; herb; ht., 1½ m.; fls., purplish; frs., red.

253.7407—SOLANUM FEROX Linn.

Five Finger Mt., Fan Ya (五指嶺,番也), 8383, Dec. 10, 1921; village commons; alt., 1000 m.; bush; ht., 1/3 m.; fls., white; frs., edible; name reported, *Mo k'e* (毛茄).

256.7407—SOLANUM HAINANENSE Hance.

Hoihow (海口), 7607, Oct. 9, 1921, *Nodoa* (那大), 7990, Nov. 19, 1921 and *Hainan, Kingchow* (海南,瓊州), 8833, Apr. 5, 1922; dry ground, roadside; alt., 10-250 m.; herb; ht., 1-2 m.: fls., blue, white, deep blue with yellow center; frs., orange, red; drug plant; names reported, *Sai tin k'e* (細顛茄), *Kam nau t'au* (金紐頭), *Puk ku lak* (卜古[illegible]), *Puk ku cheuk* (卜古雀).

256.7407—SOLANUM NIGRUM Linn.

Nodoa, Shun Ts'un (那大, ?), 8000, Nov. 15, 1921; roadside near village; alt., 250 m.; herb; ht., 1 m.; fls., white; frs., bright red; name reported, *Ta puk tsz* (打卜子).

253.7407—SOLANUM TORVUM Sw.

Hainan, Fan Ya (海南,番也), 9518, May 9, 1922; at roadside among shrubs; herb; ht., 1 m.; fls., purple.

256.7407—SOLANUM VERBASCIFOLIUM Linn.

Hoihow (海口), 7604, Oct. 12, 1921 and *Hainan, Yik Tsok Mau* (海南,亦作茂), 9704, May 18, 1922; dry grass land, wooded ravine; shrub: ht., 1 1/3-3 m.; dia., 3-4 cm.; fls., white with yellow center.

256.7415—DATURA METEL Linn.
(D. ALBA and D. FASTUOSA Lnn.)

Hoihow (海口), 7533, Oct. 9, 1921 and *Nodoa* (那大), 7943, Nov. 9, 1921; village commons; alt., 250 m.; herb; ht., ½-2 m.; fls., white; name reported, *Nau yeung fa* (鬧羊花).

256.7434—NICOTIANA TABACUM Linn.

Five Finger Mt., Fan Ya (五指嶺,番也), 8447, Dec. 7, 1921 and *Hainan, T'a Hon to Nga Wan* (海南,[illegible],牙環), 9248, Apr. 22, 1922; Loi garden, in sandy soil by edge of river; alt., 1000 m.; herb; ht., 1-2 m.; fls., pink; leaves smoked by natives; names reported, *Shang in* (生烟), *In* (烟).

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Errata Pages 11-139.

Page 118, seventh species. For 223.5493 read 216.5493

Page 134, eleventh species. For *Tsoongia axilliflora* read *Tsoongia axillariflora*

This Enumeration will be
continued in the next
issue of the Review.

NOTES ON THE CLIMATE OF CANTON

by

H. S. Frank

The time that has elapsed since the installation of the Freeman Meteorological Observatory at the Canton Christian College is still too short to allow any very definite or very sweeping conclusions to be drawn from the data that have been taken. Certain limits can, of course, be defined, and certain trends and tendencies can be traced; but the preparation of averages and the detailed analysis of statistics cannot as yet be made to yield as much information as we can hope to obtain after another ten years or so.

Maximum and Minimum Temperatures

In spite of the fact that Canton is in the torrid zone, and the further undoubted fact that foreigners are all affected more or less by the climate, the records show that the temperature does not rise high—not as high, in fact, as in many places much farther north. Since 1919, when the records of this observatory start, the hottest day of which we have any record was August 6, 1921, when a maximum of 35.8°C. (96.4° F.) was reached. On July 17, 1920, and August 4, 1923, maxima above 96°F. are also shown. In general, however, a temperature above 92° F. is very rare, and below 90°F. is the very decided rule.

On the other hand the coldest day that we know of was February 4, 1919, when the minimum was 1.4°C. (34.5°F.). On January 9, 1920, the thermometer also went below 36°F., but this too is extremely rare. Monthly minima of 40°F. in the winter months are usual.

The average daily temperature at any given time, over yearly periods, is nearly constant. The average, for all the data so far taken, of air temperatures at 7 A.M. is 19.85°C. (67.73°F.); the highest yearly average is 20.1°C. (68.2°F.); and the lowest is 19.6°C. (67.3°F.). The monthly average of daily temperature changes, of course, from month to month, but for any given month, successive years show almost no variation. The way in which the monthly average temperature changes during the year is shown in Table I, and is quite what would be expected, the lowest temperature coming in January, the highest in July and August, and the changes between being continuous. The monthly averages of temperature at 7 A.M. for this current year agree with the averages very closely, as will be seen. The greatest single variation is 1.5°F. (2.7°), and the mean variation is less than .75° (1.3°F.).

Humidity

The fact that people suffer from heat in summer and cold in winter, when the recorded temperatures do not seem to justify great discomfort, is to be attributed to the high relative humidity which is so characteristic of this climate. The records show no month in five years with an average relative humidity of less than 70%, whereas monthly averages of 86-87% are not uncommon. The yearly averages, as in the case of temperatures are constant, almost within the limits of accuracy of determination, the value being 80%. Contrary to what might be expected, however, there is very little change in average relative humidity throughout the year. It is true that the fall months are drier, but the monthly average of relative humidity is lower by only about 5% for September, October, November, and December than for the rest of the year, and the differences among themselves in the other months are negligible. All of them consistently show averages of 83-85%.

This high humidity makes the hot weather feel hotter by preventing evaporation from the skin, and thus preventing the natural cooling system of the body from operating. The mechanism whereby high relative humidity renders more intense the discomfort due to cold is less simple, but is probably also connected with evaporation. When evaporation does not take place as it should, the skin becomes clogged and hypersensitive, so that small differences in temperature make great differences in feeling.

Rainfall

The dampness of the climate also shows up in the rainfall statistics. The total precipitation varies so much from year to year, both in monthly averages for a given month, and in total annual precipitation, that it is not yet possible to speak, from our data, with much certainty on this subject. It is clear, however, that in a year we may expect in the general neighborhood of 200 cm. of rainfall, or some 80 inches. This may vary by as much as from 25-30% in either direction. Most of the rain falls in the spring and summer months, as is shown in Table I.

Changes of Seasons

Another item of some interest and importance is the precise time in the fall when cold weather starts, and when it settles down to real fall and winter weather. The first step, of course, is the shifting of the wind around to the north. This generally takes place about the middle of September. The first cold day comes after a lapse of from three weeks to a month, and is, as far as our data show, invariably accompanied by a strong north wind. It then generally warms up again for from one to three weeks, and finally the cold weather settles down as a permanent thing. The first cold spell, associated with the cold north wind, is thus possibly in the nature of a sample from farther north of the weather which is to reach us in the course of a few weeks. Detailed data on this subject are found in Table II.

Wind Directions and Force

A final point of interest concerns the force of the wind From day to day it varies between wide limits, but monthly averages of daily wind are about the same year in and year out,the figure being about 250 kilometers, or some 150-160 miles total wind passing a given point in one day. During the winter it is commonly from the north, and any shift generally corresponds to a change of weather. During the summer the same thing is true except that then it is usual to have a south wind, and anything else is to be viewed as a possible danger signal.

During July and August typhoons are by no means uncommon. They are always accompanied by a drop in atmospheric pressure of at least one centimeter, and if the typhoon passes near the observatory the pressure may drop two or three centimeters or more. The typhoon generally commences as a north breeze, stiffens to a gale, and as it attains its full strength, gradually shifts towards the east. The last strong wind is generally from the south-east, and is almost always accompanied by rain, which then persists for several days. The preliminary north breeze may sometimes last for a whole day before the typhoon proper appears. The summer of 1923 was remarkable for a large number of typhoons, some of them quite severe. In 1924, however, Canton saw nothing in the way of a real typhoon.

TABLE I

FIVE YEAR AVERAGES OF TEMPERATURE (7 A.M., DAILY) AND RAINFALL BY MONTHS

Month	Rainfall cms.	Monthly Rainfall for 1924	Temperature at 7 A.M.* centigrade		Monthly temperatures for 1924	
			C.	F.	C.	F.
January	4.75	6.64	11.0	51.8	12.6	54.7
February	12.9	13.74	12.4	54.5	12.5	54.5
March	8.85	.34	16.3	61.7	15.1	59.2
April	17.0	11.81	19.9	67.9	19.7	67.4
May	30.8	26.31	23.9	75.2	25.3	77.5
June	27.2	39.60	26.2	79.0	25.8	78.4
July	37.0	15.60	26.6	79.7	26.6	79.7
August	37.0	29.37	26.6	79.7	26.3	79.2
September	17.5	8.53	24.8	76.6	26.1	78.8
October	3.9		21.0	69.8		
November	4.1		16.3	61.7		
December	3.3		13.5	56.3		

* During the day the temperature usually rises from 3 to 6 Centigrade degrees above the reading at 7 A.M. The Fahrenheit temperatures given are calculated from the original data, which is in Centigrade degrees.

2.54 cm.=1 inch

TABLE II

DATES CONCERNED WITH CHANGING OF SEASON IN FALL.

Year	Wind turned north	First cold day (Min. Temp. below 20°C)	Definite settling in of cold	Kilometers of wind on 1st cold day	Average daily wind for month of October km.
1919	Sept. 11	Oct. 13	Oct. 13	580	249
1920	Sept. 26	Oct. 14	Oct. 22	484	247
1921	Sept. 14	Oct. 4	Oct. 25	no record	
1922	Sept. 10	Oct. 1	Oct. 31	511	231
		Oct. 11		441	
1923	Sept. 9	Oct. 10	Nov. 1	420	247
1924	....	Oct. 20	....	....	....

* * *

AGRICULTURAL NOTES

ANIMAL HUSBANDRY

Developments on Hill

The hill on the western section of the college campus is being rapidly developed by the Animal Husbandry Department. Last year a brick silo, with a capacity of fifty tons, was built and the draft animal and goat sheds are now being reconstructed on this site. These will be followed by poultry houses and hog sheds. A wide road, over which automobile trucks can be used, is being laid out west of the southeastern athletic field. Guniea grass and pigeon pea, to be used as food for the cattle, is now growing over all areas not used for buildings. During the summer months the silo was filled from these fields and proved of great value in the late winter months when the price of rice straw may be as high as $1.50 per picul. The appearance of the hill is quite different from a few years ago when the whole area was devoted to graves. The people of the island are beginning to appreciate the significance of the college program which points a way to using more upland for agriculture and thereby raising the economic conditions of the living, rather than spreading out over the area with graves and thereby devoting more than necessary of this valuable land to the dead.

Chinese Water Buffalo

During the past few years considerable data have been assembled in the dairy on breeding, cattle feeding, weight of cows, milk and fat production, and other phases of dairying. The work covering the cost of producing water buffalo milk has already been reported in Volume 2, No. 1, of this Review. In this study it was found that in the college dairy, readings on ten buffalo cows revealed a total production cost of 17.5 cents local silver (about 7½ cents gold) per pound. The expenses included in this estimate covered feed, fuel, utensils, supplies, labor, distribution of milk, and interest and depreciation on investment and cows. In fact all items were included except vaccination and supervision. The results of the study of the fat content of water buffalo milk on partial milking, and of the milk from each quarter, have been fully recorded in Volume 1, Number 2, of the Review.

Data are now being assembled with regard to the growth in water buffalo calves. This will later be reported in detail in the Review. In general, however, it may be stated that Chinese water buffalo calves grow and mature much more slowly than European calves. The first oestrum in the buffalo heifer does not as a rule occur before the calf is two years old, and frequently not before the age of two and one-half years is reached. The calf is too immature to breed under two and one-half years, and it is not advisable to breed until it is three years old. The gestation period according to accurate data on twenty three buffaloes is 345 days, or eleven and one-third months. Hence a buffalo heifer is three and one-half to four years old before the first calf is born, as compared with from two to two-and-one-half years for a European cow.

Indian Water Buffalo

Records on the milk and fat production, and feed costs, with Indian water buffalo cows, secured by the college in September, 1923, have been kept for more than a year. Our experience with these cows to date is that they give about 20% more milk than Chinese buffaloes, but with feed costs a little higher. The percentage of fat in the milk is about 8% as compared with more than 11% for Chinese buffaloes. British authorities report that in India these cows give up to 30 and 40 pounds of milk a day. Since few of our Indian buffalo cows give more than 15 pounds a day when fresh, it is doubtful if our cows are very good representatives of the breed.

European Cows

Our work with European cows to date indicates that they are much more susceptible to disease than are the buffalo cows. Because of much lower fat content European cows require less grain per pound of milk than do water buffaloes. Only one-half pound of concentrates for one pound of milk is required for the European cow, as compared with two-thirds of a pound of concentrates for the buffalo. On the other hand when giving less than two pounds of milk a day, a buffalo cow need not be fed concentrates unless in thin condition; while a foreign cow, even though in good condition, must be fed several pounds of concentrates daily or she will go down in weight and get out of condition.

Goats

The Toggenburg goats introduced from California in the year 1922, while giving a fair amount of milk, yield much less than in California. Goats should prove very satisfactory for family use as they are easy to milk. do not become soiled as readily as cows, and can be kept in small, inexpensive shelters. And there is no better milk for infants than goats' milk.

AGRONOMY

Rice

Realizing the importance of rice improvement and fertilizer tests in this part of China the Agronomy Department has given more attention to these lines during the past year than to any other of their many functions. Rice, the staple crop in this area, demands most of their attention. The studies in this field include, in the main, fertilizer tests, variety tests, and seed selection. The college has set aside, for the special fertilizer tests with rice, twenty plots each one-twentieth of an acre in area, located in the valley west of Animal Husbandry Hill. This valley is exceedingly well adapted to rice cultivation. Still other areas on the farm are devoted to variety tests. The result of practicing mass selection during the past few years is now seen in the greater uniformity of the stands. During the past year, we have begun line or individual plant selection on twenty of our best varieties, and we hope that by this short-cut method greater improvement in yield will be secured in the near future. Over one hundred varieties of rice introduced from the United States, the Philippines, Java, and Japan are being tested, of which there are two varieties that seem to give far better yields than the native varieties. Data must be assembled for a few more years, however, before we can actually prove their merits.

The department is now busily harvesting its second crop of rice and a record crop is assured. Two senior students are taking special problems in fertilizers and rice.

Effective Insecticide

Derris, known as tuba root in the Straits Settlements, is proving an effective insecticide. Further investigation carried out by the Agronomy Department reveals that the Swatow people living near Macao, who have exceedingly good gardens free from insect pests, judiciously use this insecticide. The one difficulty is that the plant cannot be secured locally even at high prices. Fortunately, however, Mr. Yip Tai Sing, a former student of the Canton Christian College, on a recent trip back to Canton from the Straits Settlements, presented to the department about two thousand plants.

HORTICULTURE

Income from Sales

The Horticulture Department is making an unusually fine showing in its drift toward self support. Of course as long as experimental and research work is carried on, and the gardens are not enlarged to the point of a commercial project it is too much to expect that the department can cover all its expenses. It is significant to note, however, that for the year 1923-24 the total expenditures, except for technical staff, were $9,794 whereas receipts netted $10,031. The department continues in its work of introducing and testing new plants, and this work is very costly. Seed production is still conducted at a loss but is warranted in view of the findings. Last year the flower gardens, under the able management of Mr. Siu Iu Nin, had sales amounting to $1,215. Vegetable production under Mr. C. K. Cheung's supervision netted sales amounting to $3,000. Our fruit production was carried on at a loss but sales amounted to nearly $2,000. We sold nursery stock valued at $1,368. The department carried most of the expenses of the herbarium except for a small grant from the College of Arts and Sciences. The department also carries most of the work connected with the sale and distribution of seeds though this is organized under the Business Division. Our seed business this year will be approximately $2,000.

Seed Production

Mr. P. K. Fu and Mr. Siu Iu Nin are continuing their work in seed production on the eastern section of the college farm. This year more than two dozen varieties of tomatoes have been secured for adaptability tests. We find that *Stone* seems to be quite susceptible to the hot weather and has a very high death rate before coming into bearing. *Chalk's Early Jewel* is proving to be an early bearing variety for this locality. Fruit of this variety ripen before November 1st. For some years we have been breeding a strain of *Money Maker* which is unusually sturdy and fruitful. It endures the local heat better than any other variety and is quite resistant to tomato wilt. This year we are also testing at least one-half dozen large edible-pod peas. The Chinese have had the small type edible-pod pea for many years but the introduction of these larger forms is proving very popular because of their tenderness and attractive appearance.

Plant Introductions from Hawaii

Through the courtesy of Mr. H. L. Chung, Agronomist of the U. S. Experiment Station at Honolulu, Mr. C. K. Cheung was able to bring with him, upon his return from the Pan-Pacific Food Conservation Conference, a number of new plants from the Island. Among these are canna hybrids, hybrid corn and tomato, and the famous Hawaiian pineapple. These new-comers have been planted out in experimental plots. Results, though not conclusive, have already been obtained from the hybrid corn. According to Mr. Chung, this corn has proved for several generations to be very successful under Hawaiian conditions. But our first planting indicates that it is rather unsuitable to this environment as it comes into bearing before the plants are matured. The ears, which should be large, are very small. A second planting will be tried later in the fall with the hope that it will do better. The "pines" are doing well and we hope later to cross them with our native variety.

Special Garden Number of the Agricultural Monthly

The November issue, Volume III, No. 5, of the Ling Nan Agricultural Monthly was a special horticultural number as a memorial to Mr. Kwok Wah Shau. The subjects discussed were: (1) The importance of scientific plant propagation to the fruit industry, by G. W. Groff and C. K. Cheung; (2) Sweet pea culture, by Shiu Iu Nin; (3) Floriculture calendar and cultural methods, by Shiu Iu Nin; (4) Calendar directions for planting western vegetables, by Cheung Cheuk Kwan; and (5) A general view of horticulture at the Ling Nan Agricultural College, by Yung Ping Hang. The issue also contained a short life sketch of Kwok Wah Shau by Ching Po Yuen and a tribute to Kwok Wah Shau by Mr. Groff.

SERICULTURE

Egg Sheet Production

Recent figures compiled by the Sericulture Department show that during the past few years we have produced an average of about 3,000 sheets of eggs annually, each sheet consisting of about 500 layings, or a total of about 1,500,000 layings in the seven crops. Owing to the slump in the market and unsatisfactory political conditions, with accompanying difficulties in taking the eggs to the market, the department has slightly reduced its production.

In this connection it is interesting to note that it is estimated that 7,000,000 sheets of eggs are annually produced and hatched in Kwangtung province. If only 25% of the eggs produce cocoons, over 500,000 piculs of raw silk would be annually reeled in this province. By using seed secured from disease free eggs, the amount of silk produced could be greatly increased without increasing the egg or mulberry leaf supply. But this would require over 70,000 sheets of disease free eggs annually, or more than 10,000 sheets per crop. In order more nearly to meet the demands of the industry the Sericulture Department needs a specially designed Rearing Building.

Eight Crops of Worms This Year

The late rains have made it possible to secure a fairly good picking of mulberry leaves during November. Consequently the Department of Sericulture is rearing a small eighth crop of silk worms this year. This crop will be finished by the middle of December.

Conditions of the Silk Market

The recent trouble in Canton when many shops and houses were burned has reacted very unfavorably upon the silk business. Many money shops were burned and looted and altho quiet and confidence have been restored banks and money shops were slow in reopening and the scarcity of money at just the time for the marketing of the cocoons of the sixth crop caused the price to drop to a very low level. For some days the silk market was closed. The price of raw silk is very low with prospects of still lower prices.

Sericulture Survey Report

Mr. Howard has been devoting much time to the compilation of data secured during the sericulture survey of the province. The next issue of the Review will probably contain sections or abstracts of this report. We may reprint entire chapters in later issues. The entire work will be translated into Chinese as the official report will be published in Chinese.

Eugene Atwood Reeling Laboratory

Construction of the Eugene Atwood Reeling Laboratory was begun when Mr. C. J. Huber, Eastern Manager of the Shanghai International Testing House, visited the college last June. To date the building has progressed as far as the first story. Construction is unusually slow, due primarily to difficulties experienced in securing building materials, as a result of breakdown in transportation during the recent political turmoil. Mr. Howard is carrying on more extended experiments with two footpower basins and he and his students frequently visit local filatures in order to determine the best line of equipment for this model filature. With the same object in view the Shanghai Testing House is continuing its experimental work along this line.

Staff Items

Associate President W. K. Chung spent recent months in Panama and South America, where with Mr. Koo Kwai Fan, a graduate of our Agricultural College, he has been campaigning in the interests of the college. Letters from Mr. Chung are very encouraging and show that the Overseas Chinese believe in the work which we are doing.

Mr. Chan Tsap Ng continues with similar work in the Western United States where we understand he has been very successful.

Mr. C. O. Levine of the Animal Husbandry Department is now in the United States where he is giving attention to the development of his farm. His present address is Marysville, Kansas. Recent letters from

Mr. Levine tell of a new home which he is building on the farm, to be followed later with barns. Mr. and Mrs. Levine and Ruth are greatly missed on the college campus.

Mr. and Mrs. F. A. McClure arrived at the college in September. Mr. McClure had been absent for two years and students and staff gave him a cordial welcome. Mr. McClure is now associated with the Biology Department where he is carrying the botany courses. He is also devoting a portion of his time to explorations in the province under the auspices of the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture. Since his return he has made several country trips.

Mr. C. K. Cheung was a delegate at the Pan-Pacific Food Conservation Conference where he represented the South China Government. In his travel abroad Mr. Cheung made many valuable contacts and enroute to and from Honolulu studied conditions and methods in Japan in food production and agricultural education. Mr. Cheung has returned from the conference very eager to establish a plant and animal quarantine base here in South China.

Mr. P. K. Fu has taken over the work in the Agronomy Department and is giving much attention to rice selection. Mr. Fu is also devoting a portion of his time to the development of the Ling Nan Agricultural Manufacturing Company which is now building near the college campus.

The college is very fortunate in having the services of Mr. Shiu In Nin in the development of its horticultural work. Mr. Shiu is unusually qualified in the practical knowledge of gardening and is well versed in the flora of China and in the common Chinese theories and practices of gardening. Mr. Shiu is devoting his attention chiefly to flower gardening, seed production and nursery stock. The result of his work with sweet peas is especially evident this year.

Mr. Frank Kan has been strengthening the organization of our Business Division. Our production is growing larger each year and thorough business methods are necessary to guarantee a maximum income from our crops. The financial limitations under which we have always operated have made it necessary for our college to develop a very aggressive business policy. This year Mr. Kan is extending his markets abroad as we have found a decided demand for some of our canned goods, especially preserved ginger and kumquats.

Mr. Pond Lee who has been carrying our courses in bacteriology has in the past been associated with the college in only part time service. He has conducted a hog plant on Honam and has been the bacteriologist of the City Board of Health. Next semester Mr. Pond Lee will give us more of his time and will organize a special course in the making of hog cholera serum, as well as in teaching several other courses in the Animal Husbandry Department.

Mr. Chiu Yan Tsz and Mr. E. H. Walker attended the summer Institute for Science Teachers, conducted last summer in Peking under the auspices of the National Association for the Advancement of Education. The conference was held at Tsing Hua College and the Peking Union Medical College also cooperated in the undertaking. Mr. N. Gist Gee was an active leader in the organization of the institute, the objects of which were: (a) to form contacts between science teachers throughout China; (b) to present type demonstration courses; (c) to use courses as an interchange of personal methods; (d) to formulate objectives in teaching science and to get hold of suitable materials; and (e) to help science teachers grow in view-point. There were about one hundred and thirty in attendance and the course lasted eight weeks.

Mr. C. N. Laird of the Chemistry Department is spending the year in Baltimore where he is devoting himself to further studies at Johns Hopkins University. We understand he is delving deeper into his food studies in which, here in China, he has a very attractive field.

Mr. Martin Yee has recently taken up work with the Chemistry Department and in addition to his teaching is also deeply interested in research. Mr. Yue comes to us from Toledo University where he was instructor in Chemistry and where he carried on research in vitamines with the Head of the Biology Department, Dr. H. H. M. Bowman. Mr. Yee is eager to carry forward his work in food analysis, especially the Chinese fruits and vegetables not commonly found in other parts of the world. Two of the senior students are now doing analytical work under him, and one, Mr. Tse Shue Pong, will take his thesis in the analysis of the food and medicinal value of the papaya.

Mr. and Mrs. Wm. E. Hoffmann arrived at the college the beginning of the first semester. Mr. Hoffmann has been appointed Associate Professor of Biology and his work will prove of great importance in our agricultural program as he is convinced that the agriculture of this region cannot be placed upon a scientific basis until we know the biology and ecology of our fauna and flora. From the point of view of research Mr. Hoffmann's chief interest is in aquatic forms and he has already begun a study of the life histories of some of the fresh water invertebrates commonly found in the fish ponds of China. Mr. and Mrs. Hoffmann were both delegates at the Pan Pacific Food Conservation Conference in Honolulu where they were also members of last summer's Minnesota Pacific Expedition which is now perfecting plans for further biological reconnaissance in the Pacific. Although busily engaged in marine biology surveys, Mr. Hoffmann still found time to do some research with a species of fresh water bug, and although unable to finish the work in Honolulu, when he left for China he took the living material with him and continued his readings aboard ship whereby he was able to get the complete life history. Mr. Hoffmann is also deeply interested in the fisheries of this part of the world, and here in the Canton Delta has an unusually attractive center in which to work. He has already aroused much interest among our students in a thorough study of the past accomplishments of Chinese in their fisheries industry and in a fuller consideration for the future. This is a very important field as it is linked very closely to the sericulture industry, the result of the common practice of feeding sericulture waste to certain kinds of fish. It also has a very definite place in our night soil parasitology studies as night soil is often fed to fish, and several species of fish are known to harbor the encysted stages of *Clonorchis sinensis*, a human liver fluke very common in this part of the world.

Mr. R. B. Falkenstein of the Biology Department has become greatly interested in the study of the life history and habits of certain so-called stink bugs, known to the Chinese as Ch'ou pi tan (Ch'au p'i t'an--臭屁蛋). In this part of the world we have several very highly decorated species of these *Pentatomidae* which are very destructive and are causing our fruit growers great losses. One, *Tessaratoma papilloesa,* is the most destructive of all the insects attacking the lychee. It has very interestingly taken on a protective coloration which resembles the highly colored lychee fruits. Another very destructive species, which, being green-colored, resembles citrus fruits before they become ripe, attacks the mandarin and sweet orange, and other citrus relatives. These insects alone are causing losses extending into the millions each year, and we wish Mr. Falkenstein much success in discovering methods of attack. Mr. Kam Yue T'ang, one of our senior students, has become interested in this line of investigational work, and is taking his thesis in this subject.

Death of Mr. Kwok Wah Shau

It is with deep sorrow that we record the death of Mr. Kwok Wah Shau on July 14th. Mr. Kwok was sick for a little over a month. He was buried at his home in Heungshan district. Mr. Kwok came to the college in the year 1917 when he was engaged in the cooperative work carried out between the college and the United States Department of Agriculture in the field of citrus investigation. At that time we were hunting canker resistant strains and Mr. Kwok accompanied Mr. Groff in his travels over the province. They carried out a thorough study of the citrus fruits of the region and Mr. Kwok made detailed drawings and records on specially prepared blanks which he later assembled in manuscript form and placed on file in the Office of Crop Physiology and Breeding Investigations of the United States Department of Agriculture. During recent years Mr. Kwok had been in charge of the fruit orchards and nurseries being developed by the college and had assembled a fine collection of native citrus fruits for Dr. Walter T. Swingle, with whom we are still in collaboration. The findings of Mr. Kwok in this field have never been published but in the very near future the Ling Nan Agricultural College hopes to see his citrus work in print. The College has lost one of its best research men as Mr. Kwok was unusually fitted for investigational work. The Agricultural Monthly, in Chinese, has already published a memorial number, and we hope to present in a forthcoming issue an article on the life and work of Mr. Kwok Wah Shau.

Night Soil Studies

The work on the hookworm and night soil studies reported in previous issues of the Review has been continued throughout the summer and fall months. A crop and fertilizer questionaire in Chinese was circulated and followed up by one of Dr. Oldt's men. The results were translated and tabulated by Mr. P. K. Fu. In cooperation with the Horticultural Department an experiment with fertilizing "t'ang ts'oi" (藤 菜), *Basella rubra* Linn., a leaf vegetable crop of the Chinese, with night soil subjected to various lengths of time in storage, was carried out during the summer months. This fall a new and more extensive project has been set up in which wheat will be the field crop. This experiment consists of mixing night soil with various commercial fertilizers, as garbage, ammonium sulphate, saltpeter, gypsum, lime, and ashes. Dr. Oldt has been conducting weekly examinations of samples from each of the jars in this set-up to determine the effect of these fertilizers upon hookworm larvae. Mr. Chiu Yan Tsz and Mr. Martin Yee of the Chemistry Department have been running analyses from each jar to determine loss of nitrogen in the various mixtures These mixed fertilizers will then be tested on wheat to determine their relative fertilizing values. Two of the senior agricultural students are assisting in taking the readings on these experiments and in the analytical work in the laboratory.

Dr. N. R. Stoll, of the China Hookworm Commission, spent ten days at the College in November and reviewed the work carried out here. Dr. Stoll has been associated with Dr. W. W. Cort in the hookworm program launched in China under the joint auspicies of the Department of Pathology of the Peking Union Medical College and the International Health Board of the Rockefeller Foundation. Their main field laboratory has been at Soochow and their work closed November, 1, 1924. Dr. Cort returned to Johns Hopkins School of Hygiene and Public Health last summer and Dr. Stoll returned immediately after leaving the College.

When it is realized that approximately fifty percent of the people living in the tropics and sub-tropics are believed to be infected with hookworm, the significance of this work to public health is at once apparent. In China the problem is a peculiar one because of the use of night soil on the fields. We understand that the China Hookworm Commission is fully convinced that they cannot get anywhere in their work of eradication until their conclusions and recommendations have had the approval of agricultural experts. In the large the problem has to do with agriculture, chemistry, bacteriology, public health, and medicine. Very little research has been carried out upon the reactions that take place in human feces from the time they leave the body until they are taken in as food by the plant. The effect of storage upon the eggs and larvae of parasites, the bacteriological and chemical action resulting from different methods of treatment, nitrogen loss, and methods of retaining the plant foods until ready to be assimilated by the plant are problems of vital importance to both health and food conservation in China, and in the world at large. One phase of the night soil-parasitology problem which we have not yet investigated is its relationship to the fish industry. We are fortunate in having as the head of our Biology Department Mr. Wm. E. Hoffmann, who is extremely interested in making a study of fish culture in this part of the world and who hopes in the near future to get some work started along this line. These various lines of research must first be carried out before we can expect to attack the problem in a thoroughly scientific way. Dr Frank Oldt of the Canton Hospital and United Brethren mission should receive the credit for being one of the first to do much work upon the viability of hookworm larvae in stored feces. We await with interest the reports of analyses now being made by the Chemistry Department. Our present lines of attack of mixing night soil with commercial fertilizers will certainly guarantee less harmful results from the use of chemical fertilizers, and we look for the cooperation of those interested in the introduction of such fertilizers to China. On the whole we feel that our College has a decided contribution to make in this field. We have the personnel but are sadly lacking in necessary equipment.

Farm Experience

One of the requirements of the Ling Nan Agricultural College is that no student shall graduate from the College without being able to show that he has had at least eight weeks' experience in practical agricultural work. Last summer twenty students devoted their summer vacation to this requirement. They carried out their work in the college barns, fields, and nurseries, and in rearing silkworms. Some of them worked in the Kowloon Dairy and others on the farm of Mr. Hoh Leung, one of our graduates, who is operating in the Kowloon Territory. Several of the advanced students, who are specializing in sericulture worked in the filatures in the districts; and two of them spent several weeks at the Shanghai Testing House. One worked on the farm of the Shantung Experiment Station. Many of these men assisted, for a part of their time, in carrying out a farm survey at the College. All of this work is very practical and is appreciated by the students.

Agricultural Scholarships

One of the great needs of our College is scholarships for worthy students. We have requests from a large number of men who are unable to pay the school fees but who are willing to work part-time for any help we can give them. At present we are able to meet the requests of these men only in part. When Mr. C. K. Cheung was in Honolulu he secured for our College two new agricultural scholarships valued at $150 Gold each year. These were presented to the College by Mr. Chung Ai of the City Mill Company and by Dr. Dai Yen Chang, both of Honolulu. A deep appreciation is felt by both the students and staff for this interest and help.

The Lingnaam Agricultural Manufacturing Co.

The organization of this company was reported in the last issue of the Review. Construction of the first barn of the company began October 14, and it is now about ready for the roof. The plan of this barn is similar to the design by Prof. Levine for the Agricultural College and, with his permission, the company is altering it slightly and using it. The two wings of the barn will accommodate sixty-two cows and the central part is for food storage. The company will be ready to serve customers with sanitarily produced milk within three months' time. The Canton store will probably be on the Second Bund, a few doors from the Hotel Asia and Sun Company.

The company has also planted about fifteen hundred papaya trees and quite a large raspberry patch so that its patrons will have opportunity to purchase these delicious fruits.

Boxer Indemnities and Rural Uplift

During recent months considerable interest has been shown in China in the use to which the returned Boxer indemnities will be applied. The application of the American fund has been turned over to a Sino-American Joint Commission of nine Chinese and five American members. In connection with the work of the Board, Dr. Paul Monroe of Teachers' College, Columbia University, New York, has recently been in China, and his views are of significance to rural uplift. Dr. Monroe feels that the entire mass of the Chinese people should be benefited and for this reason he strongly advocates that the fund be devoted to the educational improvement of village life, for city people have many more opportunities for enlightenment than have the country people.

How the British Boxer Indemnity will be applied has not as yet been decided and we understand a commission is coming to China to study the situation. We have noted that the Japanese Diet has approved of an appropriation of 6,500,000 yen for the erection of two research laboratories in China. It has been stated that an Arts and Science Research Laboratory will be built in Peking, and a Natural Science Research Laboratory in Shanghai. This year's appropriation from the fund is announced as 970,000 yen. Certainly research in natural science will make a direct contribution to the agricultural development of China, and Japan is to be congratulated upon her choice. It now seems that the country people of China are about to receive, in some measure, help from these funds for the payment of which they have been taxed during these many years.

China Wood Oil

A marked interest is being exhibited in wood oil both in England and in the United States. American varnish manufacturers, realizing that they are securing insufficient quantities of the oil from China to meet their needs, are planning to plant large areas of trees in Florida. The Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture has recently requested seeds of *Aleurites montana* (Lour.) Wils. for their experimental studies. Mr. F. A. McClure has secured a small quantity from the Hongkong Department of Forestry. He also went personally to Wuchow, Kwangsi, to study the trees first hand, to take photographs, and collect more seed.

There has been in the past considerable confusion as to the distinguishing features of some of the species of *Aleurites*. This is due in part to errors committed by early botanists, as for instance the describing of a new species from the leaves of one species and the fruits of another. There is also considerable variation within each species and the distinctions are difficult to make unless sufficient material for comparison is at hand. *Aleurites fordii* Hemsl. is the species cultivated almost exclusively in Central China. *A. cordata* Steud. is the species found most commonly in Japan, according to E. H. Wilson. *A. montana* (Lour.) Wils. and *A. moluccana* Willd. are the two species found most commonly in southern China. The former seems to be attracting special attention lately. The Hongkong Department of Forestry is planting six piculs of seeds of this species with a view to establishing a plantation.

Camphor Plantation in HongKong

The Department of Forestry of Hongkong is also entering upon another intensely interesting enterprise, a camphor plantation. They are utilizing for this purpose a small valley near Little Hongkong which has hitherto borne a nearly virgin forest. All the trees which are fit only for wood are being cut out. Some very fine mature specimens of *Bischofia javanica* are to be seen. There are also many splendid trees of a wide-leaved species of *Cinnamomum* reputed to be very productive of camphor gum.

Interest in the Rural Church

Throughout China there is widespread interest in the development of the rural church. The National Christian Council has been endeavoring to arouse interest in this subject and has secured the services of Rev. Morton Ch'u and Mr. Chang Hen-chiu for work in connection with the Rural Church Committee. Mr. Ch'u and Mr. Chang are spending the fall and winter months travelling in Fukien, Kwangtung, and Korea. The aims of their travels are: (1) to study the rural church as it is to-day; (2) to determine ways and means for training rural workers; (3) to find an adequate implement to solve the problem of rural illiteracy; (4) to get into touch with mission agricultural experiment stations and colleges; and (5) to encourage the Christian forces to arrange a special rural program in connection with summer conferences, conventions, and synods of 1924. When it is recalled that China has approximately 300,000,000 rural population, 1,000,000 hamlets and at least 40,000 market towns, the importance of this line of approach is apparent.

Mr. Ch'u and Mr. Chang visited us for a few hours November 26 but were unable to remain as they had been recalled to Shanghai. They worked in the Swatow field from November 2 to November 15. The Ling Nan Agricultural College is attempting to do all it can to foster this interest. The relationship of the College to a Preacher's Conference held here last summer was the most satisfactory that we have ever experienced. A number of conferences between the agricultural staff and the delegates were held. Each day from 4.30 to 5.30 P.M. a trip over some section of the farm was carried out. A questionaire was worked out which was answered by many of the preachers. The September issue of our Agricultural Monthly was a special number devoted to a consideration of the rural church, and contained articles by both the staff and pastors. More than one hundred churches in this province are now receiving our Monthly regularly, and we shall be glad to extend the service to other southern provinces.

The December issue of the Chinese Recorder is a special rural church number. All interested should make a special effort to read it. Under agricultural reviews we record the contents of this number.

Agricultural Explorations in China

The United States Department of Agriculture has been exploring the agricultural resources of China for many years. The late Frank N. Meyer, who travelled widely in northern and central China, Turkestan, Russia, and Siberia, was widely known throughout this country. He was followed by C. A. Reed who worked in the walnut-growing regions of China and Joseph F. Rock who explored the remote and little-known southwestern portion of this country. The Department has now launched a Northwestern China Expedition, headed by Mr. P. H. Dorsett. Mr. Dorsett and his son are working in the provinces of Chihli, Shansi, and Manchuria where they are making an intensive search for hardy crop plants, fruits, and shade trees that will benefit principally the northern portions of the United States, and especially the Great Plains region. Forage crops and cereals of value are likely to be found in China, for the Chinese for many centuries have been cultivating and improving their crop plants. The soy bean has now become important in the United States and new varieties from this part of the world should be thoroughly tested. North America has already introduced several hardy, drought-resistant shade and windbreak trees from Northern China. And western nurserymen are not slow to recognize the importance of wild fruits, or wild relatives of fruits they are growing, secured from these regions, which they can use to great advantage in breeding or as root-stocks. The Northeastern China Expedition will continue its explorations for a year or two and will work in cooperation with local agriculturists and horticulturists, so that China should profit as fully as the United States from these researches. In southern China explorations of the Department are carried out in cooperation with the Canton Christian College which is making an exhaustive survey of the flora and plant resources of Kwangtung. As stated elsewhere Mr. F. A. McClure of our staff is now representing the Department in this field.

Dr. Joseph F. Rock has during the past few years been pioneering in the fields of botanical and agricultural explorations in the unknown regions of southwestern China. Last summer he spent a day with us at the College, en route to the United States, after several years' sojourn in Yunnan and Szechwan. His expedition was conducted under the auspices of the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture and the National Geographic Society. Starting from Bangkok Dr. Rock proceeded northward into the semi-independent state of Kentung. Passing through Kenglaw he entered Yunnan where he collected widely. From Yunnan he travelled northward to the Likiang Snow Range, exploring the mountains in the Yangtze loop, and in the independent Lama Kingdom of Muli in southwestern Szechwan. He then went westward and worked along the Mekong-Yangtze divide and the

Mekong-Salwin divide, and finally came out again through Yunnanfu. A recent letter from Dr. Rock, addressed from Yunnanfu, dated December 10, 1924, informs us of his new explorations in this field. These we understand are under the auspecies of the Arnold Arboretum, but with the National Geographic Society and the United States Department of Agriculture still cooperating. On this trip Dr. Rock is fortunate in being able to secure the services of his former guides and assistants, most of whom are men from Likiang in northwestern Yunnan. From Yunnanfu Dr. Rock is proceeding through central Szechwan via Suichow, Chengtu, and Lungngan, and thence through Kansu via Linchow and Sinning. He expects to explore the Annie Maclin Range near the source of the Yellow River, and the Richthofen Range northwest of Sinning. He will then make his way through Chinese Turkestan to Kashgar via Urumchi. From Kashgar he expects to go across the passes into Russian Turkestan where he will strike the Trans-Caspian Railhead. We shall follow Dr. Rock's explorations with keen interest, and hope some day to see many of his plants in our herbarium or living specimens on our campus.

Mr. F. R. Wulsin, another explorer attached to the National Geographic Society has recently passed through Hongkong en route from Kweichow province, via Yunnanfu and Haiphong. Mr. Wulsin has been doing some very intensive collecting in China. He is specially interested in zoological studies though he is also collecting botanical material. Prior to last summer most of his work was in northern China, especially in the province of Kansu. We hope Mr. Wulsin will again visit southern China, after his return from the United States, as he has some very constructive ideas for the study of the natural history of China. This work needs to be done also for the coming generations of Chinese students. Through Mr. Wulsin's cooperation we have assembled a collection of about one thousand numbers of plants representing the flora in a confined area in the North River region. These we are forwarding to him to Washington so that he may have them identified.

Still another form of agricultural exploration is that now being carried out in China under the auspices of the College of Agriculture of the University of California. This consists of research work in China for the purpose of searching for, and shipping to California, natural enemies of citrus pests, particularly the red and purple scales. The scale pests of citrus are costing California growers alone several million dollars annually. Inasmuch as parasites of these insects are commonly observed in China, it is safe to assume that probably at least a part of this loss may be eliminated, through the introduction of these parasites into California, by the use of the biological control method. The University of California is extremely fortunate in being able to secure, for this work, the services of Dr. F. Silvestri, Director of the Zoological Laboratory of the Royal School of Agriculture at Portici, Italy, who is widely known for his researches in polyembryony and other phases of the biology of parasitic insects. In addition to several foreign collecting trips for the Italian Government, Dr. Silvestri was employed some years ago by the Hawaiian Board of Agriculture for work on the natural enemies of the Mediterranean fruit fly, when he succeeded in introducing into the Hawaiian Islands from Africa several valuable species of parasites of this pest. Dr. Silvestri has recently visited the College and under the guidance of some of our men has made collections in our own groves and in those surrounding the College. One of the very interesting phases of his work is that he finds many of the same scale insects infesting *Citrus* common also on species of *Erythrina*, belonging to the family *Leguminosae*, and other wild and cultivated plants. In view of the severe quarantine on *Citrus* in California, much of his living material is therefore sent upon *Erythrina*. Dr. Silvestri expects to spend at least a year in this work. He has already visited Japan and Formosa and has been to Shanghai, Hongkong, Macao, Sunwui, Foochow, Amoy, and Swatow.

Floods and Famines in China.

The disastrous floods of last summer have made necessary further extensive relief work. The need was promptly taken in hand by the China International Famine Relief Commission which is well organized for efficient and honest service. While it is very difficult for this committee to obtain accurate knowledge covering all the areas, in late August they estimated the number of people affected in the various provinces as follows:

Province	**Population**	**People Affected**
Hunan	28,000,000	4,760,000
Metropolitan Area	4,000,000	800,000
Chihli	30,000,000	5,100,000
Kiangsi	24,000,000	240,000
Fukien	13,000,000	130,000
Kwangtung	34,000,000	2,590,000
Shantung	31,000,000	310,000
Honan	31,000,000	310,000
Hupeh	27,000,000	540,000
Chekiang		No details yet.

It is an accepted principle of this Commission to carry out relief projects which will provide labor for the able-bodied victims by inaugurating labor relief construction which is revenue-producing or revenue-conserving, and which will tend to prevent future catastrophes of a similiar nature. It is also a purpose of the Commission to require the repayment, over a period of years, of funds thus expended, and thus they increase their permanent revolving funds which makes it possible during the interim between floods and famine to carry out further famine prevention work. The situation has been fully discussed by Mr. W. H. Mallery, Secretary of the China International Famine Relief Commission and by Mr. J. E. Baker and Mr. O. J. Todd in the China Weekly Review, Novermber 22 and December 6, 1924. Under our Agricultural Reviews we give a summary of these articles.

We understand that Professor J. B. Tayler, Director of the Economics Department of Yenching University, has very recently returned from India where he was making studies of India's flood and famine prevention program on behalf of the International Famine Relief Commission of China. Professor Tayler believes that China particularly needs something on the order of the Farmer's Cooperatives in India, in order to fight against famines.

Progress in Agriculture at Peking University (Yenching)

The Department of Agriculture at Yenching is now well organized and we note under group five of their Announcement of Courses for 1924-25 that courses are being offered in a Division of Agronomy, Division of Animal Husbandry and Dairying, Division of Poultry Husbandry, Division of Horticulture, and Division of Agriculture. Additional courses are offered in problems of Chinese country life, and sources of agricultural information. Students taking these courses are eligible for the degree of Bachelor of Science.

We understood that Yenching is especially interested in animal industry and they are importing pure bred beef and dairy cattle from America. Prof. Bransford Eubank, a graduate of the Texas Agricultural and Mechanical College, is to head this work.

Growth in the College of Agriculture and Forestry, University of Nanking

The tenth annual report of this College, which has just come from the press, states:

"The year under review has witnessed a rapid expansion of our work due in large part to the new projects undertaken in connection with our Famine Prevention Program which has been approved by the American Famine Fund Committee. There has been a big increase of teachers, associates, and assistants. Instruction has been better cared for, our extension work has been considerably enlarged, and all investigation and research work much more effectively organized. The annual grant of $5,000 from the Shanghai Forestry Fund Committee has been renewed for another period of three years. An agricultural and forestry newspaper has been effectively launched. Much needed equipment for class, laboratory, and field use has been added. We have had more requests from missionary and Chinese interests for co-operation than we could take care of. The year's work in sericulture, cotton, and cereal improvement has been highly successful. Our direct contacts with the farmers have been greatly increased. We are four-fifths of the way towards the $100,000 required for the erection of the badly needed College of Agriculture and Forestry building."

The University of Nanking in its College of Agriculture is pressing forward in its ten years' famine prevention program for which it has a fund, allocated by the American Committee for China Famine Fund of New York, of $675,000 gold. This college now has eleven departments: Agricultural Economics and Farm Management, Agricultural Gardens, Agronomy, Bacteriology, Botany, Cotton Improvement, Extension, Forestry, Plant Pathology, Rural Education, and Sericulture. Many new research and extension projects have been organized.

Chinese Government Colleges of Agriculture

We are sorry that we are unable, in this issue, to give as full reports of the Government Colleges as we should like to give. We understand that Peking and Southeastern are both going forward with their work in spite of recent disturbances in those areas. Their program is well under way and we trust there will be no serious check to their progress. In the South there has been a reorganization of college interests under the Kwangtung University with a College of Agriculture located on the site of the former Experiment Station at Tungshan. We hope in our next issue to give fuller reports of all of these institutions.

AGRICULTURAL REVIEWS*

BAKER, J. E. Saving China's famine sufferers for a better day, in the *China Weekly Review* Vol. XXXI, No. I, pp.15-17, four illustrations.

Mr. Baker, who is Co-treasurer of the China International Famine Relief Commission, states that for the purpose of definition the Commission has decided that a famine does not exist unless it affects ten contiguous districts, or one-third the total number of districts, in a province. The standard of living for the rural population of China is so low that to the casual observer of sympathetic instincts proof of famine would be conclusive under almost any conditions. But the economic conditions of the country side of China have never been fully surveyed. The policy of the more recent organizations of famine relief is contrasted with the method of giving relief employed in China for centuries which has been to treat all alike within an allocated region. The difficulties of the sifting practice are many, for Chinese wit is most fertile in resources in suppressing any appearance of wealth. Eight interesting considerations for inspectors are given. The writer explains the bad moral and physical effects attending the former methods of charity employed in famine relief. He then discusses the expense for engineers and tools when the more modern method is used, and he gives figures to show the comparatively low amount of money needed for these purposes as compared with total expenditures. But the chief value in a constructive famine project is the training of leadership, which China needs so badly. Thus the work of the Commission is primarily that of producing seed, which broadcasted over the country at large produces a crop yielding a hundred fold.

BAKER, JOHN EARL. Food transportation in China, in the *Mid-Pacific Magazine*, Vol. XXVIII, No. 4, pp. 323-333, eleven illustrations.

This is a paper prepared for the Pan-Pacific Food Conservation Conference, pointing to the inadequacy of China's primitive transportation systems for the relief of food and famine swept districts. He points at considerable length to the Chinese railway system as a wonderful instrument of relief, giving comparative data in the famines of 1877-78, before the construction of modern railways, and in 1920-21 when railways were used for relief. He deals with the severe strain put upon the railways to handle all the traffic offered at that time and lists methods of relief. Several pages are devoted to a discussion of road building undertaken since the 1920-21 famine, including the 850 miles financed by the American Red Cross, of the construction of which the writer was in charge.

CHANDLER, ROBERT E. What the N.C.C. committee on rural problems and the country church is trying to do, in the *Chinese Recorder*, Vol. IV, No. 12, pp. 811-813.

This committee is carrying out investigations and promoting efforts to meet the needs: (1) of making the country church and school minister to the needs of the community; (2) for a volunteer movement for rural workers; (3) for theological seminaries and Bible schools to train direct for country work; (4) of health improvement work in the villages; (5) of driving opium and other narcotic drugs out of the country; and (6) of developing systems of popular education. Mr. Chandler discusses the work of the committee under these headings.

*Note: These reviews have been compiled almost entirely from articles, books, and bulletins dealing with agriculture and rural life in China. In a few cases we review publications not written with special reference to China but with a very direct application to conditions here.

Beginning with Volume three, Number one, we hope to publish English reviews of publications appearing in Chinese. This service will be inaugurated under the leadership of Mr. C. K. Cheung who is our Director of Agricultural Education and Extension. Our college agricultural students will assist Mr. Cheung in compiling these reviews which we expect to be of great service to English readers interested in following progress in agriculture and rural life in China.

CHAPMAN, B. BURGOYNE. Training Christian leaders for country work, in the *Chinese Recorder,* Vol. IV, No. 12, pp. 785-789.

Mr. Chapman, as a result of his many years' experience in China in teacher-training, has given in this article a masterful presentation of the ideals and difficulties involved in training men and women for country work.

CHIAO CHI MING. Mapping the rural community, in the *Chinese Recorder,* Vol. IV, No. 12, pp. 805-809, and one map.

This discussion relates to a rural community survey the writer made in the Yao Hwa Men area near Nanking. The market town and each village was visited and customs of worship and business were both studied. This article should be read by those trying to uplift any rural community in China.

CHINA INTERNATIONAL FAMINE RELIEF COMMISSION. Engineering accomplishments, famine prevention and relief projects, 1921-23, *Publication Series A*, No. 7, 18 pp. plus one map.

This is a report of the accomplishments of the Commission with its engineering projects, giving expenditures, sketch maps and interesting facts noted in brief. It states that new roads constructed by the American Red Cross China Famine Relief Commission and the International Commission, if put end to end, would provide two trunk highways reaching from Shanghai to Chungking, and from Peking to Canton. In providing water for regions subject to drought twenty-five miles of irrigation ditches and seven thousand wells were dug.

CHINESE GOVERNMENT BUREAU OF ECONOMIC INFORMATION. The *Chinese Economic Bulletin*, IA Chang Pu Ho, Nan Ho Yen, Peking, Numbers 176 to 201 inclusive.

The Chinese Govenment Bureau of Economic Information is a non-political organization which provides economic, commercial, financial, and industrial information relating to the Republic of China. The Chinese Economic Bulletin is a ten to fifteen page pamphlet issued weekly. It contains many articles on agricultural and related industries, and is invaluable to the student of the economic life of China. Many of the issues contain special notes on industries, agriculture, and communications. Much valuable statistical material is recorded. A complete index to Nos. 150-175 has been issued by the Bureau. We cannot review the many helpful articles but the subjects of a few in which we have been most interested are: Rice Polishing Mills in Hankow, and Bean Consumption in South Fukien, in No. 177; Cotton Market in Hankow, and Rhubarb in Szechwan, in No. 178; The Lichee of Canton, and Goatskins in Szechwan, in No. 180; Why Silk Filatures in Dairen Fail, and Chinese Rhubarb, in No. 181; Survey of 202 Farm Families, Land Distribution in Canton, and Tung Oil, in No. 182; American Tobacco in Shantung, and Afforestation in Shansi, in No. 184; Possibilities of China Raw Silk, in No. 186; Szechwan Grasscloth, in No. 187; Sericulture in Kwangtung, and Cotton Experiment Stations in Shansi, in No. 188; Cotton Crops in Nantungchow Region, in No. 190; Bone Dust in Tientsin, and Agricultural Budgets in Shantung, in No. 191; Money-lending Agencies for the Poor in China, Bamboo Sprout Cultivation, and Agricultural and Industrial Conditions at Menghwa, Yunnan, in No. 192; Rural Credit in Nanking, Hupeh Gypsum, and Cotton Production in Shansi, in No. 194; Ancient Methods of Cultivation Revived in Shansi, in No. 196; The Tan Sheep Skin of Ningsia, Fukien as a Fir Producing Province, and China's Silk Trade, in No. 197; Manufacture of Flower Scented Tea in Foochow, and Developments in the Bean Oil Industry in Harbin, in No. 198; The Bamboo Art Work in Kiating, in No. 200; and Liquorice Digging in the Ordos, in No. 201.

Chinese Government Bureau of Economic Information. The *Chinese Economic Monthly,* address as above, Volume 2, Nos. 1, 2, and 3.

This is issued monthly in regular bulletin form of about thirty pages. In addition to the articles there is a section devoted to book reviews. Recent subjects dealt with are: Agricultural Conditions in Southern Kiangsu, Sericulture Improvement in the Shanghai District, in No. 1; Sheep Rearing in China, in No. 2; and China's Cotton Production, Land Tenure and Farm products in Southern Kiangsu, Steam Filatures in the Shanghai District, and Survey of 40 Cotton Farms in Southern Kiangsu, in No. 3.

Chung, H. L. The meaning of agricultural conservation for China in the *Mid-Pacific Magazine*, Vol. XXVIII, No. 3, pp. 223-227, five illustrations.

This is a paper prepared for the Pan-Pacific Food Conservation Conference in which the author points to China's past history in conservation and to the impending dangers which threaten to jeopardize China's agriculture. These he considers under forests and water supply, food crops, and livestock. He believes that a solution to China's problems of conservation must be found in higher education for the agricultural profession, so that China may have well trained foresters, entomologists, pathologists, and animal husbandmen and veterinarians who can work upon the problems.

Chung, K. T. Rural China and future missionary policy, in the *Chinese Recorder*, Vol. IV, No. 12, pp. 809-811.

Mr. Chung believes that rural China will be won for Christ if evangelistic forces are more adequately distributed, if self-supporting churches are founded at the start, if the right kind of leaders receive specialized training in rural work, and if members of the church are better cared for in Christian nurture.

Collins, James H. Story of Florida's plant wizard, in the *California Citrograph*, June, 1924, reprinted by permission from Farm and Fireside.

The people of China should be more fully informed with regard to the life and work of Lue Ging Gong who was born in the Canton delta, and who is now widely known in the United States as the " Luther Burbank of Florida ". We have published a story of his life, in Chinese, in our Agricultural Monthly and are glad to see that the western world is beginning to recognize his genius. Mr. Collins' story is an interesting account of his work.

Djang, Y. S. Will the Chinese farmers remain financially independent?, in the *China Weekly Review,* Vol. XXX, No. 12, pp. 362-363.

Mr. Djang states that it is apparent to even a casual observer that the farming population of China is hopelessly at the mercy of the rich, and unless some fundamental measures are taken will continue to be so. A proper banking system for the farmer is one of the first great needs. At present the interest rate in the case of pawning his movable property at the pawnbrokers is generally 36 per cent per annum, if the term of the loan is for three months. When he pledges his farm land he has to pay an equally high rate. The tendency is to reduce free holders to tenants, and to transform independent farmers to slaves of feudalism. The writer believes the rich can find no better field for investment than the vast area now devoted to agriculture. Under the present existing rural economic organization improvement of agriculture is only a dream. The China International Famine Relief Commission has appointed a special Committee on Credit and Economic Improvement which is studying systems of cooperation which have been successful in various others countries, and which will draw up a set of working regulations for cooperative credit societies in China.

Feng, Rui. A program of Chinese agriculture, *Thesis*, Cornell University, June, 1925, 8 pp.

This is the abstract of a thesis presented for the degree of Doctor of Philosophy. The discussion covers land system, crop system and farm work planning, methods of maintenance of soil fertility, agricultural sciences, agricultural trade and commerce, agricultural education, agricultural administration, and references and bibliography. The thesis in manuscript form consists of 383 pages. Judged from the abstract, it contains many hints of value in any agricultural program in China.

Fronda, F. M. Cantonese—a new breed of poultry, in *The Journal of Heredity*, Vol. XV, No. 9, pp. 371-376, five illustrations.

The writer describes this new breed of poultry which is native to the region of Canton, China. He pictures its success in the Philippines where it thrives better than any of the standard breeds of poultry. He states that it was imported into the Philippines in 1914, and that by selection a more uniform and productive type has been developed.

Griffing, J. B. Elementary agricultural text for rural schools, published by *Edward Evans & Sons*, Shanghai.

This is the first volume of a series of agricultural texts, in Chinese, which we understand Mr. Griffing is writing for use in primary and middle schools. A teacher's manual is to accompany the text. Both text and manual are illustrated with original drawings. The translation is by Mr. Shao Teh-hsieng. These books will meet a long-felt need in China.

Griffing, J. B. Saved again, in *University of Nanking, College of Agriculture and Forestry, Miscellaneous Bulletin Series*, No. I.

This very interesting story by Mr. Griffing is written in a delightful manner, and pictures the great opportunity in China to-day for rural service. This story has been translated into Chinese, and has had an exceedingly enthusiatic reception on the part of both the Chinese and English speaking Christian educators and evangelists. It has been reprinted in a number of papers.

Griffing, John B. A Christian school with a rural message, in the *Chinese Recorder*, Vol. IV, No. 12, pp. 801-805.

Mr. Griffing discusses a rural school experiment at Wukiang, Anhwei, which is located in the country and serves actual farm life. The teacher is of low academic standing, with a little agricultural training, and a love for country work. The breaking away from classical traditions was at first misunderstood and disapproved by the school constituency, but the final impression was in marked contrast and inspired confidence in an agricultural extension program in the region.

Groff, G. W. The rural church, in the *Chinese Recorder*, Vol. IV, No. 12, pp. 775-782.

This paper is a discussion of the city-country problem in China with a statement of the opportunities open to the church for strengthening rural leadership. It embodies, in large part, the thoughts and recommendations of the Committee on Agricultural Education of the China Christian Educational Association, and of the Rural Church Committee of the National Christian Council.

Ho, Chieh-shiang. China tea manufacture by machinery, in the *China Weekly Review*, Vol. XXX, No. 3, pp. 78-81, four illustrations.

It seems strange to the writer that while machinery has been universally applied in tea manufacturing in India and Japan, the oldest of all the producing countries in the world, China, is still in urgent need of its introduction. The article records an attempt at reform by several Chekiang men who have organized the Tsing Wah Machine Manufactured Tea Company. The writer describes the mechanical process, as also the traditional Chinese one, and then gives a comparison of the tea manufactured by the new and the old methods.

Ho, Chieh-shian. Present status of the spinning industry in China, in the *China Weekly Review*, Vol. XXX, No. 4, pp. 108-109.

The writer summarizes the situation in a single sentence: "Chinese interests have passed from the stage of development to a path of decline while the Japanese are making rapid strides and the British position remains unchanged." He then recites the history of the Chinese in the spinning industry which does not date back further than 1900. During 1918 and 1919 the cotton industry in China rose to great prominence, and many new mills sprang up in all parts of China. In 1921 the yarn market became gradually depreciated, but the situation did not become serious until 1923. One of the chief reasons for the marked decline of the industry is that during the war the Chinese merchants proceeded under an illusion that, as a result of the world war, they were free from external competition, and accordingly they spen tenormous sums for new machinery. This accounts for the unnatural and hollow increase of spindles during a time when the price of raw cotton ran steadily higher, and the demand for yarn was extremely limited. The writer then gives figures to show the situation, tabulating the number of spindles and number of factories from 1919 to 1923. One promising feature of the situtation is the increase of looms which is also shown by statistics. The concluding paragraphs endeaver to prove by statistics that every loss to China in the spinning industry has proved an appreciable gain for Japanese interests.

Impey, Lawrence. Flood, famine and civil war in North China, in the *China Weekly Review*, Vol. XXX, No. 5, pp. 150-153, nine illustrations.

Mr. Impey states that ten thousand square miles of farm land were under water in the province of Chihli, over one hundred and fifty serious dyke breaks were reported in North China alone, the damage done in the one city of Kaigan was estimated to run into millions of dollars, and the total destitute peasantry was computed to be more than ten millions at the very time chosen by the Tuchunate to launch a fresh civil war upon the unfortunate populace. The article deals with the preparations for war while "millions of unregarded peasants find themselves daily one step nearer starvation, unless indeed they accept the alternative of conscription and brigandage."

Impey, Lawrence. The theory and practice of famine prevention in the *China Weekly Review*, Vol. XXIX, No. 13, pp. 441-447 with seven illustrations.

Mr. Impey is a civil engineer formerly connected with the American Red Cross International Famine Relief Commission. His article is an analysis of the constructive policy in China during the last three years, pointing to permanent relief rather than direct and temporary relief. He states that in the last decade over $35 000,000 has been expended in China in famine relief work. He explains the history of labor relief measures in China and mentions the work of the American Red Cross in China in 1920, when there was carried out work of a constructive nature in four provinces, to the value of over $2,400,000, the expenditure of which in famine relief constructed 900 miles of highways, built 4,000 wells, and planted 40,000 trees. He then gives summaries of reports of provincial committees from the provinces of Chekiang, Kiangsu, Anhwei, Hunan, Hupeh, Honan, Shansi, Shantung and Chihli. His conclusions point to the increasing tendency to let out relief work on a contract basis, to the desirability of loans for provincial work for engineering projects which furnish "both an object lesson and a practical school of experience to the young Chinese engineer, and by virtue of the benefit accruing to agriculture, a very valuable source of increase in revenue to the Chinese Republic."

JOWE, PETER S. The wood oil market in China, in the *China Weekly Review*, Vol. XXX, No. 11, pp. 340-345.

The writer states that Hankow, by reason of her geographical position is the throat of the bottle for the wood oil producing districts of China. Wood oil is now attracting the attention of the business men of Hankow more than any other product. The size of the wood oil crops in 1923 was approximately 600,000 piculs, while the 1924 crop is estimated at 800,000 piculs. The market in 1923 was highly irregular, but in 1924 the prices were much more normal. The writer discusses at some length how unsettled conditions in the country have affected the business, and he believes that adulteration is not a serious one as most of these firms now employ testing experts. He also lists Chinese firms interested in the field and gives the Chinese names of important places of production. In closing he deals with the fact that China's wood oil market is now being threatened by the American varnish manufacturers project to produce China wood oil in America. This is a comprehensive article of the China field for wood oil, but we see little reference to the South China business which passes through Hongkong.

KELLOGG, C. R. Save the birds of China, in the *China Journal of Science and Arts*, Vol. 2, No. 6, pp. 546-549.

The object of Mr. Kellogg's paper is to point out how invaluable birds are, and to arouse more interest in their study and protection in China. In recording their food habits the data is from the examination of American birds. He refers to the activities of the woodpecker, night-hawk, dart, sparrow, titmouse, swallow, mourning dove, and cuckoo. The writer points to the need of laws to protect the birds in China, especially when we note the rate at which guns are coming into China.

LAWDERMILK, W. C. AND SHEN HSIEH-LI. Summary university meteorological records, 1895-1923, in *University of Nanking, Agriculture and Forestry Series*, Vol. I, No. 8.

This is the first publication on Nanking weather data issued by the University. In connection with the Freeman Meterological Observatory the University hopes to establish a cooperative weather station at each of the permanent Mission Stations.

LEVINE, C. O. Rice production in far away China, in *The Rice Journal*, Vol. 27, No. 10, pp. 9 and 13, two illustrations.

Mr. Levine discusses consumption, types of rice grown, methods of planting, cultivation, irrigation, fertilization, harvesting, threshing, hulling, and polishing in use in China.

Levine, C. O. Poultry production in China, in *Farm Mechanics*, October, 1924, pp. 20-23, five illustrations.

Mr. Levine shows by actual figures that the poultry business in China is very large, and that the export trade is rapidly increasing. He estimates the number of laying hens in China at 350,000,000, and the average production per hen at 75 eggs. He discusses feeds and feeding, caponizing, and breeds of chickens in China. He mentions the Langshan, known in China as Shanghai, the Swatow breed of which there are two varieties, the white and the buff, the Silkies, Frizzles, and Cantonese. He writes very briefly of the Chinese white, and the Chinese brown geese, as also the small gray variety found in southern China. He mentions contagious diseases and parasites common here. He discusses at great length and pictures Chinese incubators, some with a capacity of 200,000 eggs.

Levine, C. O. The milk supply of the Orient, in the *Mid-Pacific magazine*, Vol. XXVIII, No. 6, pp. 503-513, ten illustrations.

Mr. Levine first points out that although the Tibetans on the west and the Mongolians on the north of China have consumed milk and products made from milk as far back as history records, nevertheless the Chinese who have traveled widely in Mongolia and Tibet have held themselves aloof from this practice of their neighbors. Until the advent of the Westerner and the western educated Chinese students in China, the Chinese apparently not only left milk entirely out of their diet, but seem to have had the idea that milk from farm animals was an excretion of waste products rather than of health and strength giving fluid. However, the milk idea has now been sold to the Chinese, and the author believes that there is no doubt that many of the 90 per cent of the babies in China who die before normal weaning time, are the victims of improper feeding. The sources of fresh milk in China are then considered with special stress, upon the exceptional food value of water buffalo milk. Mr. Levine reviews the experimental work with the water buffalo carried out by the Ling Nan Agricultural College, full reports of which have been published in this Review. He gives comparative figures in the cost of producing buffalo milk, 38 cents Mex. per quart, with that of the Holstein cows at the Canton Christian College, 42 cents Mex. per quart. He refers to studies in Hongkong, Peking, and Shanghai. The chief drawback to the production of milk in China he believes to be: (1) rinder-pest, (2) the need of government inspection and quarantine laws, (3) the need of health departments in our large cities which will properly protect honest dairies, and (4) widespread education in instructing the school children and the citizens generally in the value of milk.

Liang, M. T. International cooperation in famine relief, in the *China Weekly Review*, Vol. XXX, No. 10, 304 pp., ten illustrations.

This is a brief statement of the merging in 1921 of organizations interested in famine relief in China into what is now known as the "China International Famine Relief Commission" which allows for Chinese-foreign cooperation in a way that if extended to other spheres of activity in general would bring "peaceable accommodation and rapid progress in the Far East."

Mallory, W. H. The serious famine situation in China, in the *China Weekly Review*, Vol. XXX, No. 12, pp. 360-362, with eight illustrations.

Mr. Mallory is the Executive Secretary of the China International Famine Relief Commission and he gives a statement of the distressing conditions resulting from the floods of July and August, 1924. He estimates that twenty million dollars will be required to meet the emergency. He states five sources from which relief funds might be expected: a national flood relief drive, the Maritime Customs surtax, a transportation surtax, mission sources, and Chinese sources. But all of these sources have been adversely affected by the outbreak of civil war. The only hope for the victims of this terrible disaster appears in the China International Famine Relief Commission.

MAO YUNG (毛雝), Bibliography of Chinsee literature on agriculture, (中國農書目錄彙編) *University of Nanking, publications of the library,* Number 1. Mex. $1.00.

China is rich in the treasure of agricultural books and papers written by her ancient scholars. These are scattered and have never before been very systematically classified. Mr. Mao has done a very valuable piece of work which will be of great assistance to westerners interested in Chinese agriculture, and to the Chinese themselves in preserving and using their old books. This attempt classifies only the ancient Chinese literature on agriculture, and excludes all translations and works on modern agriculture. Although it contains an immense amount of material, 214 pages, it is confessedly incomplete because the investigators were limited to the libraries of Nanking and vicinity. The work is divided into 21 classes: general agriculture, climatology, meteorology, farm implements. water resources, famines, nomenclature, biology, production, farm crops. tea culture, forestry, animal husbandry, sericulture, fisheries, agricultural manufacturing, agricultural economics, home economics, miscellaneous discussions, and miscellaneous principles regarding agriculture. The subject matter is classified under five columns: (1) name of the book or articles; (2) the number of volumes to the set; (3) author's name; (4) if only an article, the book in which it is found; (5) general remarks. Our only criticism is that the work would have been even more helpful had the compiler indicated a little more fully regarding the subject matter under each entry, as the titles of the books do not always suggest the nature of the contents, and the classification followed is a little too general. Had each entry been numbered it would not be difficult to make cross indexes to authors, subjects, etc. An English translation would of course make the work of more value in western countries.

PALMER, MAJOR MORGAN. Colonising in Manchuria, in the *China Weekly Review,* Vol. XXX, No. 9, pp. 270-272.

For more than two centuries Manchuria was practically closed to colonisation from within the Eighteen Provinces of China Proper, for the Manchu Dynasty kept this vast territory, larger than France and Germany combined, as their ancestral domain. The writer mentions the few attempts, made since the establishment of the Republic, to use Manchuria as an outlet for the surplus population of Chihli and Shantung. He deals particularly with the Manchuria Development Company, a venture started through the efforts of Mr L. S. Palen, and financially assisted by Honorable Charles R. Crane, and the late Major Willard Straight. The article is a most interesting account of this project which was upset by the great war and failed, but since has been reorganized and is offering opportunity for immigrants. The writer states that the Famine Relief Commissions are now seriously considering sending some of their refugees to this rich northern country where famine is practically unknown. He describes the excellent climate and numerous attractions of the region. Some idea of the temperate nature of the country is drawn from the fact that Korean colonists are now growing rice.

PAN, S. L. China's silk trade with America, in the *China Weekly Review*, Vol. XXIX, No. 9, pp. 296-304.

We understand that this, and succeeding articles, have been taken from a chapter of Mr. Pan's new book, "The Trade of the United States with China" which is being published by the China Trade Bureau, Inc., Woolworth Building, N. Y. Mr. Shu-lan Pan is a graduate of St. John's University, Shanghai, Harvard and Columbia Universities. We look forward with pleasure to seeing this work.

It is the purpose of the author in this article to show how China has been defeated in the American silk market and in the world, and what effort she is now making to get back at least some part of her share in America. He compares the history of China's silk trade with America, with that of her tea trade. Like tea, silk has been a Chinese monopoly for centuries past, but foreign countries after introducing these industries have succeeded, partly at least, in driving China out of the market. But there is at least one point in which the silk trade differs from the tea trade. While machinery has been very largely introduced into the tea trade in foreign countries, sericulture on the other hand requires an immense amount of labor. In this respect China is in a very strong position. If China continues to pay more attention to silk, as she is now doing, the writer believes that it will not be long before she will resume the predominant position that she held in the past, in the silk trade world. The writer develops, and gives statistics to show the early history of China's silk trade with America, the decline of China's trade in manufactured silks, and the expansion of the raw silk trade. He laments the lack of effort on the part of the Chinese to develop sales and devotes considerable length to the energetic pushing of the Japanese of their silk trade. He accuses the Chinese silk producers, manufacturers, and merchants of having lived in a fool's paradise. He gives figures to show American imports of raw silk by countries from 1185 to 1922 and also quantity and value distribution. The author concludes by saying that "from 1850-59 two-thirds of the American raw silk import came directly from China and nothing from Japan. Two decades later (1875-84) China's share declined to less than two-thirds, while Japan shared equally with China in the American trade. Since that time Japan has secured a constantly increasing share, one-half of the whole during the period 1885-1904, two thirds, during 1905-13, and about three-fourths to four-fifths, since 1914. China's share on the other hand has contracted from one-fourth during 1885-1904, to about one-fifth since 1905. It is the decline of the comparative importance of China's silk trade with the United States that we refer to when we speak of the defeat of China in the American market.

PAN, SHU-LUN. Chinese vs. Japanese silk and the U. S. vs. the European market, in the *China Weekly Review*, Vol. XXIX, No. 10, pp. 327-329.

This article is the portion of a chapter on China's silk industry. Mr. Pan briefly outlines the history of China silk, and the weaving industry in America, and Japanese silk, prior to the world war. He then deals with the changes that have taken place since the war including the recent improvement of Chinese sericulture, and the first serious attempt in this direction, made in 1909, when the Silk Association of America adopted resolutions for the improvement of Canton filature skeins. This led to an increase in China's share of the American silk market. The author then points to Chinese government cooperation, in the form of subsidies for the improvement of silk. He also mentions the substantial help of the American Silk Association, especially gifts to Canton Christian College and Nanking University, and through the visits of the American Silk Mission to China. The close of the article deals with waste silk and its importance in the industry.

Pan, Shu-lun. The decline of China's tea trade with America, in the *China Weekly Review*, Vol. XXIX, No. 12, pp. 402-408 and continued in No. 13, pp. 434-436 and 450-451.

This is a very scholarly article, describing in a delightful manner the history of the tea industry in China, and the early history of the trade between the United States and China including China's part in "The Boston Tea Party of 1773." He the deals with the growth of the teatrade in line with the development of the American merchant marine, giving figures to show the relative proportion of the tea to other Chinese imports into the United States from 1820 to 1860. This is followed by the history of the Japanese competition which began about 1856. Mr. Pan writes: "From 1856 to 1894, a period of three decades, the imports of tea into the United States had been more than trebled in consequence of the expansion of the nation and by increase of population, both the Chinese and Japanese imports having increased in absolute amounts. Yet the Japanese share became larger and larger, while China's suffered an irrecoverable loss. He develops very fully this decline of the Chinese tea trade with America, including the causes of the decline. Mr. Pan follows with the rapid development of the tea industry and trade in India, which were almost unknown in that country a half century ago. He gives many figures to show the competition that developed between Chinese and Japanese tea with that from the British East Indies and the Dutch East Indies. He then shows the inefficiency of Chinese methods and the consequences of the adulteration. He points to the additional handicap due to the heavy export duties on tea imposed by the Chinese government. He concludes: "Due to the combined working of the external and internal causes, China's tea trade has dropped from 100 per cent sixty years ago to less than 12 per cent in 1920. Mr. Pan gives citations to numerous authors dealing with this subject. He concludes: "Due to the combined working of these external and internal causes, China's tea trade with America has dropped from 100% sixty years ago to less than 12% in 1920. This serious drop has been attracting the attention of the Chinese for a long time and measures toward removing the internal causes have been taken up .... It is, therefore, to be assumed that the Chinese tea trade with America has passed its bottom stage. Here-after, owing to the greater attention that both the Chinese government and tea merchants have been giving to the tea trade, Chinese tea will be in position to meet the competition of those from other countries. But, nevertheless, one fact is already settled: that China will never regain the old prestige of her tea trade in America. In fact the United States has long since ceased to be a good customer for China's teas. During the last ten years, it took no tea exports of China, and in some years, as little as 14°/o.

Reisner, John H. *Agricultural and forestry notes*, College of Agricultural and Forestry, University of Nanking, China, Numbers 1-11.

Dean Reisner is issuing monthly, in four pages form, this new series of University of Nanking publications. The sheet is made up almost entirely of items of interest and information about the work of the College of Agriculture and Forestry.

Reisner, John H. The Church in rural work, in the *Chinese Recorder*, Vol. IV, No. 12, pp. 790-797.

In this article Dean Reisner gives a brief history of the agricultural missionary and his achievements in China. This is followed by a summary of experiments and projects in "rural" and "agricultural" education by missionary agencies in China, under 25 headings relating chiefly to localities.

Sowerby, Arthur De C. Famine, floods, and folly, in the *Journal of Science and Arts*, Vol. 2, No. 5, pp. 395-399, and ten illustrations.

The discussion, and the illustrations, are based very largely upon the Tientsin floods of 1917, and of the damages at that time compared with those of the present year. Mr. Sowerby calls upon the country for a deeper interest in reforestation, and to prohibit the cutting away of underbrush, and raking up the grass for fuel. He deplores the inaction of the government, and the wrangling and fighting for further power in the land, when the people are drowning and dying of famine.

Swingle, Walter T., Robinson, T. Ralph, and May, E. J. The solar propagating frame for rooting citrus and other subtropical plants, *U. S. Dept. Agr. Department Circular 310,* 13 pp. and illustrated.

This bulletin describes a rooting frame of simple construction which utilizes sunlight as a source of bottom heat, and which has been found to give excellent results in rooting cuttings of citrus and other subtropical plants. We mention it because the propagation of fruit trees by the so-called method of Chinese air-layering is, from many points of view, unsatisfactory, and this device may be of service to plant propagators in China. It has been used successfully with lychee cuttings with which Messrs. Swingle, Robinson, and May are working.

Taam, Sik Hung. Recent scientific investigations in lychee culture, *specia Ling Nan Agricultural College Bulletin,* in Chinese, Canton Christian College, Canton, China, 18 pp. and 11 illustrations.

Mr. Taam's work is a translation of three appendices which appeared in The Lychee and Lungan by G. Weidman Groff published by the Canton Christian College and Orange Judd Company in 1921. These are: (1) The Lychee a Mycorhizal Plant, by Frederick V. Coville; (2) Lack of Winter Dormancy and the Low Zero Point of Growth of the Lychee Limiting Factors in Its Culture in Florida; and (3) Rooting Lychee Cuttings by Means of a High Temperature and High Humidity Process, by Edward Goucher. These papers, all by experts of the United States Department of Agriculture, give the reader advanced ideas regarding propagation, soil, and climatic limitations for lychee culture. In his introduction Mr. Taam points to China's ancient and rich treasures in cultivated plants and western interest in them. He believes the requirements for lychee culture are difficult to obtain in other parts of the world, and he calls upon the people of Kwangtung to rise up and increase the production of lychee in order to meet the world's needs. He hopes the translation of these papers will be a help in this direction.

Takahashi, J. A Japanese bulletin on Washington navel oranges, in Japanese, listed as *Research Bulletin No. 2 of the Imperial Horticultural Experiment Station,* Okitsu, Japan.

This bulletin will be of interest to those in China who may be interested in the introduction of the Washington navel orange. There is a resume, printed in English, pointing out the principal citrus regions in Japan, and the results of studies of forty-four introductions of this orange in Japan.

Thone, Frank, Ph. D. A botanical Marco Polo, in the *Independent,* Vol. 113, No. 3887, Nov. 29, 1924, pp. 451-452.

This is a very interesting and popular account of the travels of Dr. Joseph H. Rock, referred to elsewhere in the pages of this Review. Mr. Thorne writes: "There recently arrived in Washington, sojourned briefly there, and departed again, a man whose pilgrim's pack would have furnished forth a nine day's wonder nine times repeated could he have brought it to Venice or Genoa during the Renaissance. This was Dr. Joseph H. Rock, botanical explorer, fresh from the jungles and mountains of unknown southwestern China, with sixty thousand specimens of plants for the United States National Herbarium, pictures innumerable, and unlimited data for the National Geographic Society, and tales of wonder that he may never even have time to tell. For he is one of the brotherhood of the itching foot and is already off for the unknown once more.

"The primary object of the trip was to get botanical material........ Sixty thousand pressed plant specimens,......, he dumped on the shelves of the National Museum......The Department of Agriculture gets seeds of hundreds of different kinds of plants......As a mere incident, the National Museum receives the skins of some 1,600 birds, including some very rare and beautiful pheasants, as well as a few valuable mammal skins."

"The pride of the whole collection, for example, is the group of rhododendrons, no less than about 1,200 separate kinds, and seeds of 493 species and varieties .... Again, there are several species of chestnuts in the collection, some of them from giant trees eighty or ninety feet high, with trunks six feet in diameter ..... The chestnuts appear to be blight-proof, and may in time help to replace the native American species, which is now virtually extinct."

TODD, O. J. The 1924-25 engineering program for flood relief, in the *China Weekly Review*, Vol. XXXI, No. 1, pp. 18-25, with eight illustrations.

Mr. Todd is the Chief Engineer of the China International Famine Relief Commission, and he explains their policy of giving relief by providing labor to the heads of destitute families. He then discusses at considerable length the new problems, from an engineering standpoint, arising from the recently flooded areas, and the organized methods of operation employed, including the feeding and housing of the men, and the supervision of the engineering staff. Under their present plan, unit costs for operation are obtainable. He mentions four proposed projects for 1925 and describes each under: (1) the irrigation project west of Peking; (2) the Yellow river reclamation in Honan; (3) the Kiangsi reclamation along the lower Kan river; and (4) the Hunan flood relief. The last paragraph deals with what the Commission hopes to do.

TSAU, P. W. The Boxer indemnity and agricultural science, in the *China Weekly Review*, Vol. XXX, No. 4, pp. 107-108.

Dean Tsau of the College of Agriculture, National Southeastern University, anticipates great success attending the use of the indemnity money on agricultural science. Under six headings he develops the great need for agricultural education and then gives four significant agricultural problems needing study and solution: cotton improvement, forestry development, control of animal diseases, and the need of agricultural experts. The final suggestion is that there should be a Bureau of Agricultural Improvement of China with a Board of Trustees appointed by the Indemnity Committee.

TUNG, T. F. The food problem in China and how to solve it, in the *Mid-Pacific magazine*, Vol. XVIII, No. 5, pp. 463-479, nineteen illustrations.

The author believes that no problem is more important in this country than the very complex one of food supply. Peace will never visit the earth unless there is a surplus of food. China has long been an agricultural country, and has produced the largest amount of food among all the nations in the world. But during recent years the price of food has grown so high that many people have become pauperized. The tremendous shortage of food results in the cry of hunger from every locality. The author gives four main reasons why food is so deficient in China: (1) the rapid increase in population to what he believes now to be near 500,000,000; (2) the development of industry and the consequent movement of farm laborers to the city; (3) the cultivation of special crops, as cotton and tobacco, which are now being grown on areas formerly devoted to rice; (4) famines resulting from floods and drought, and insect damage. Other reasons mentioned are exportation, neglect of improving rural social and economic conditions, and the disuse of barren lands. The actual amount of food deficiency in China is apparent from the 1920 import figures which show more than 10,000,000 tan of rice, 1,000,000 tan of beans, 50,000 tan of corn, and several thousand tan each of buckwheat, barley and wheat brought in from outside countries. As to the methods of solving this complex problem the author believes China must use both the British method of cultivating undeveloped areas, and the German method of improving plant varieties, soil conditions, methods of culture, and the general social and economic conditions of rural life. He develops this idea, under five heads, giving some very interesting figures and statements. Under three headings he also develops the importance of proper methods for food distribution: (1) the improvement of means of transportation; (2) the improvement of the marketing system which he believes is very bad in China due to innumerable middlemen; (3) improvement of the taxation system, especially the tax levied on food imports now controlled by foreigners, and that known as "Likin", collected locally at a number of stations instead of at the place of consumption. Other methods mentioned by the author for the control of the food problem in China are: (1) food storage; and (2) the determination of price. Mr. Tung's article is one of the most scholarly that we have seen on this subject, and should be read by all true friends of China. The article was prepared for the Pan-Pacific Food Conservation Conference, and the author believes the success of this conference will help bring about a solution of the problem in China.

UNITED STATES DEPARTMENT OF COMMERCE. *China Monthly Trade and Economic Report*, published at the Office of the Commercial Attache, Shanghai, China, the 15th of each month.

In addition to a resume of general business conditions, and detailed statements regarding exports and imports and exchange and banking conditions, there is given in these monthly mimeographed reports paragraphs regarding agriculture and crops. One can follow current events in China as related to business in a most helpful manner. The republication of material in these reports is not permissable.

UNIVERSITY OF NANKING. Famine prevention program of the College of Agriculture and Forestry as approved by the China Famine Fund Committee, *Agriculture and Forestry Series*, Vol. I, No. 9.

This is a conprehensive statement of the ten years' program before the University of Nanking, and of the personnel of the China Famine Fund Committee. The program calls for instruction in forestry, forest research, forest extension, agricultural extension, farm crops improvement and seed farm, economic and farm management studies in famine areas, co-operative extension work, plant and animal disease control, rural engineering and rural education. A research library is also being organized and scholarships are granted to agriculture and forestry students.

YARD, JAMES MAXON. Our theological seminaries and the rural pastors, in the *Chinese Recorder*, Vol. LV, No. 12, pp. 782-784.

The writer outlines the things he would include in a theological course for the country pastors. He is of the opinion that there needs to be vigorous pruning of nonessential courses in every School of Theology of every grade in China.

YOUNG, ROBERT A. Taros and yautias; promising new food plants for the south, United States Department of Agriculture, *Department Bulletin No. 1247*, 22 pp. and many illustrations.

We mention this bulletin as one deserving the special attention of residents of China because the cultivation of taros is very common here, and because a number of the varieties described were received from China.

YOUNG, ROBERT A. The dasheen; a southern root crop for home use and market. *U. S. Dept. Agr. Farmers' Bul. 1396,* 35 pp., 26 fig.

This is a companion bulletin to the above and is of a more popular nature. It contains some very helpful instruction for preparing the dasheen for home use and for market.

* * *

AGRICULTURAL PUBLICATIONS
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General Bulletin No. 5 **Groff, G. W.**, Agricultural Reciprocity Between America and China. 34 illustrations. 20 pages. English. $0.20.

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Same also in Chinese (宰畜製肉指南). $0.20

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" " " 8 Price List of Seed and Nursery Stock. English and Chinese. $0.20.

Howard, C. W., The Sericulture Industry of South China. 32 pages. 8 illustrations. English. $0.30.

Taam, S. H. Recent Scientific Investigations in Lychee Culture (研究荔枝之新發明). 18 pages. 11 illustrations. Chinese. $0.20.

PERIODICALS.

The Lingnaam Agricultural Monthly (農事月刊) (Chinese).
$0.90 Mexican or $0.50 gold per volume

The Lingnaam Agricultural Review (English).
$2.00 Mexican or $1.00 gold per volume

TEXTS.

Groff, G. W., The Lychee and Lungan. 68 illustrations. 188 pages. $5.00 (Also published by Orange Judd and Co., New York).

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